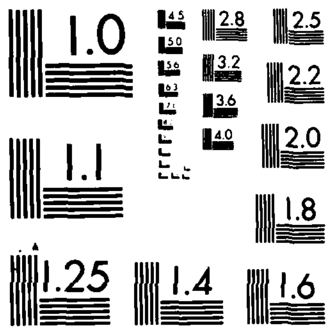
AD-A159 127 1982 CRC FUEL RATING PROGRAM: ROAD OCTANE PERFORMANCE OF OXYGENATES IN 1982 MODEL CARS(U) COORDINATING RESEARCH COUNCIL INC ATLANTA GA JUL 85 CRC-541 1/3

UNCLASSIFIED F/G 21/4 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

CRC Report No. 541

(6)

AD-A159 127

1982 CRC FUEL RATING PROGRAM: ROAD OCTANE PERFORMANCE OF OXYGENATES IN 1982 MODEL CARS

July 1985

85 09 11 023

COORDINATING RESEARCH COUNCIL, INC.
219 PERIMETER CENTER PARKWAY, ATLANTA, GEORGIA 30346

COORDINATING RESEARCH COUNCIL
INCORPORATED
219 PERIMETER CENTER PARKWAY
ATLANTA, GEORGIA 30346
(404) 396-3400

1982 CRC FUEL RATING PROGRAM: ROAD OCTANE PERFORMANCE OF OXYGENATES IN 1982 MODEL CARS

(CRC PROJECT No. CM-124-82)

Prepared by the

1982 Analysis Panel

of the

Octane Technology and Test Procedures Group

July 1985

Light-Duty Vehicle Fuel, Lubricant, and Equipment Research Committee

of the

Coordinating Research Council, Inc.

TABLE OF CONTENTS

Page

TABLES

FIGURES

APPENDICES

I. INTRODUCTION

Road octane rating programs have been conducted periodically since 1963 by the Coordinating Research Council (CRC) Light-Duty Octane Technology and Test Procedures Group to investigate the relationships between the laboratory properties of a set of motor gasolines and the Road anti-knock performance of these fuels in selected groups of cars. The programs of 1971, 1973, 1975, and 1978 tested unleaded gasolines with a wide range of Research octane number (RON), Motor octane number (MON), and sensitivity. Variables evaluated were RON, MON, aromatics content, and olefins content. The testing was done by Octane Technology and Test Procedures Group participants from the oil industry at their own laboratories. The last program, conducted in 1980, evaluated heavy aromatics content and ethanol content in addition to RON and MON. This program revealed a large variation among cars and car models in their response to the test gasolines. Most of the thirty-seven test cars showed an adverse effect of adding heavy aromatics, and some of the cars showed beneficial effects for ethanol in the gasolines.

Because of the widespread interest in the use of alcohols and ethers as gasoline blending components, the present program was conducted to evaluate the effects of several oxygenates on gasoline octane performance and to evaluate the effects of car design features such as engine and transmission type.

II. SUMMARY

Five oxygenates were evaluated at two nominal concentrations, 5 and 10 volume percent, at both regular- and premium-grade octane levels: methanol (MeOH), ethanol (EtOH), isopropanol (IPA), tertiary butanol (TBA), and methyl tertiary butyl ether (MTBE). A blend of 5 percent MeOH and 5 percent TBA was also tested at both octane levels.

Two different techniques were used to analyze the data obtained in this program. The "conventional" method, used in all previous programs, analyzed data from all of the fuels together. Missing data were estimated using individual car regression equations. Data were analyzed by using multiple linear regression and analysis of variance techniques. Certain analyses were made with all-car average data; other analyses were made with data from individual cars. On an all-car basis, full-throttle Road octane numbers (Road ON's) were found to be well-predicted by the following equation containing only RON and MON:

$$\text{Road ON} = 29.96 + 0.289(\text{RON}) + 0.400(\text{MON})$$

The standard deviation and R^2 are 0.173 Road ON and 0.988, respectively, for this equation.

Multiple regressions were conducted to evaluate the effects of toluene, the oxygenates, and also squared RON and MON terms. It was concluded that $(RON)^2$ was needed to provide a good fit, and that toluene, TBA, and MTBE had beneficial effects on Road ON over and above their effects on RON and MON.

The second analysis technique used in this program took a different approach. Road ON prediction equations were developed for each car and for all cars using only the six hydrocarbon fuels. The all-car equation is:

$$\text{Road ON}_{HC} = 30.36 + 0.322(\text{RON}) + 0.347(\text{MON})$$

The standard deviation and R^2 are 0.261 Road ON and 0.989, respectively. A new term, called Road Octane Performance (ROP), was devised to represent the Road ON performance of the oxygenates as compared with hydrocarbon blending components. ROP is defined as follows:

$$\text{ROP} = (\text{measured Road ON}) - (\text{predicted Road ON}_{HC})$$

where the predicted Road ON is calculated using the prediction equations for the individual cars. A positive value indicates a Road ON benefit; a negative value indicates a deficit.

The addition of the oxygenates was found to cause nonlinear increases in all the ON's: Road ON, RON, and MON; the effects tended to level off with increasing concentration. For this reason, evaluation of the oxygenate effects was conducted separately for the low and the high concentrations.

Using ROP as the dependent variable, data analyses were conducted to evaluate the effects of the oxygenates. In the regular grade fuels at full throttle, all the oxygenates showed benefits, i.e., improved Road ON performance relative to hydrocarbon blending components. They gave higher Road ON's than expected judging by RON and MON. No trend was readily apparent in premium fuels.

Oxygenates in regular-grade fuels had highly significant beneficial effects in six-cylinder engines as a group (including both "inline" and "V" type engines), whereas the four-cylinder and V8 engines showed smaller, and non-significant, effects. With the premium fuels, none of the engine types showed significant effects; however, the V8's showed significantly poorer responses than the other engine types. There was no significant effect of transmission type.

The part-throttle results did not show any trends. This was probably due to the fact that only nine cars were tested at part-throttle, and that repeatabililty is poorer in part-throttle testing.

III. TEST PROGRAM

Testing was done by ten participating laboratories, as shown in Appendix A. The data were analyzed and the report written by the Panel shown in Appendix A. The text of the program proposal is presented in Appendix B.

Twenty-eight unleaded fuels, including four hydrocarbon fuels, two hydrocarbon fuels plus toluene, and twenty-two oxygenated fuels, were rated in duplicate in thirty-eight cars using the Modified Uniontown Technique (CRC Designation F-28-75 described in Appendix C), plus some additional instructions. All testing was done on chassis dynamometers. Ratings were obtained at full throttle* with all thirty-eight cars, and at the most critical part-throttle condition (occurring with manifold vacuum of 4 in. Hg (13.5 kPa) or greater above the full-throttle vacuum) with nine cars. Part-throttle ratings were determined from part-throttle primary reference fuel curves. The instructions also requested that the fuels be rated in random order, that three accelerations be made for each rating, and that the maximum speed be investigated for Modified Uniontown rating not exceed 60 mph (97 km/h).

IV. TEST FUELS

Five oxygenates - MeOH, EtOH, IPA, TBA and MTBE - were evaluated in each of two base gasolines, one just below the regular unleaded gasoline octane level [85-86 (R+M)/2] and one just below the premium unleaded gasoline octane level [89.5-90.5 (R+M)/2]. It was intended that the oxygenate blends would be at the regular and premium octane levels. The five oxygenates were blended into the base gasolines at nominal concentrations of 5 percent (low level) and 10 percent (high level) by volume. In addition, MeOH and TBA were tested in combination at a nominal concentration of 5 percent each. Each base gasoline was tested "neat" and with 15 volume percent toluene. Two special gasoline blends were included to improve the evaluation of the effects of RON and MON. The test fuel design is shown in Figure 1; the target test fuel specifications are shown in Table I.

---

* The ratings were actually obtained at maximum throttle, as described in the CRC E-15 Octane Number Requirement Technique. To make for easy reading, the words "full throttle" are used in this report.

RON, MON, R-100, and M-100 inspection data for the test fuels were supplied by many of the participants. R-100 and M-100 tests are RON's and MON's run on the front-ends of gasolines distilled to 100°C. The octane data were screened for outliers and then averaged. Five laboratories supplied analyses of oxygenate concentrations. These data are shown in Appendix D. There is no standard method of analysis for oxygenate concentration, and the specific technique used by each laboratory submitting oxygenate analyses was not stated. An available gas chromatographic method is described in the Journal of Chromatographic Science.(1) The data submitted were examined, outliers rejected, and the remaining values averaged. For all twenty-eight test fuels the measured properties critical to the test program are compared in Table II. Additional measured fuel properties are shown in Table III. Gas chromatogaphic analyses of the four hydrocarbon fuels are tabulated in Table IV. Fuel 4, regular-grade base gasoline plus 7.78 volume percent MeOH, showed phase separation at several laboratories. Hence, this fuel was not run in several of the test cars.

V. TEST CARS

Thirty-eight cars representing thirty different 1982 models were used in the program. Eight cars were equipped with manual shift transmissions, and thirty with automatic transmissions. The manual shift cars all had four-cylinder engines. There were twenty-three cars with four-cylinder engines; twelve with six-cylinder engines, of which nine were V-type and three were inline; and three with V8 engines. The test car models and their engine/transmission characteristics are shown in Table V. The odometer mileages ranged from 3,204 to 35,092 miles (5,156 to 56,475 km).

Though the program attempted to test a broad range of engine/transmission combinations, there is no assurance that the cars actually tested will represent the population of 1982 model cars on the road.

---

(1) R. E. Pauls and R. W. McCoy, "Gas and Liquid Chromatographic Analysis of Methanol, Ethanol, Tertiary Butyl Alcohol, and Methyl Tertiary Butyl Ethers," Journal of Chromatographic Science, Volume 19, November 1981, pp. 558-561.

VI. BLENDING OCTANE NUMBERS

The RON, MON, R-100, M-100, and Road blending octane numbers (BON's) were determined for each oxygenate/concentration combination and toluene in the premium and regular base gasolines. Figures 2 and 3 show Road BON's plotted versus oxygenate concentration. In all but one case, the BON's were lower at the high concentrations. For this reason, the BON's were not averaged for each gasoline grade/oxygenate combination. Table VI shows BON's for the low and high oxygenate concentrations in both grades of gasolines, and for toluene at 15 volume percent.

Figures 4-6 were plotted to illustrate the effects of some of the variables on blending Road ON. The blending ON's shown on the figures are based on averages of the low and high concentrations. Figure 4 shows that the Road BON's were consistently higher for the oxygenates in the regular grade gasolines than in the premium grade gasolines. For toluene, the premium BON was higher, however. Figures 5 and 6 show that, in general, the Road BON was about halfway between the RON and MON BON's, as expected for hydrocarbon gasoline components. There were two exceptions, however: methanol/TBA had a low Road BON in the premium gasoline, and t-butanol had a high Road BON in the regular gasoline.

The front-end octanes, R-100 and M-100, generally showed much higher BON's than their counterparts, except in the case of toluene. This verifies the high octane quality and volatility of the oxygenates.

VII. ROAD OCTANE EQUATIONS

The individual Road ON's (Appendix I) were averaged over all thirty-eight cars to obtain mean values for use in developing Road octane equations. They are listed in Table VII for both full-throttle and part-throttle ratings. Missing data were estimated using the individual-car regression equations tabulated in Appendix E, Table E-I. Also included in Table VII are the standard deviations and the minimum and maximum Road ON's.

The average data were regressed using a standard multiple linear regression technique. The results of the regressions can be found in Appendix E, Table E-II for the full-throttle data, and Table E-III for the part-throttle data. Table VIII is a summary of the more pertinent full-throttle regression equations. The "goodness of fit" of the equation which uses only RON and MON is shown in Figure 7. As shown in Table VIII, the equation using (R+M)/2 was almost as good as the equation using RON and MON. The inclusion of a $(RON)^2$ term gave some improvement, as shown in Figure 8.

Inclusion of terms for the individual oxygenates along with RON and MON did not improve the correlation, and their coefficients were not statistically significant. Toluene, TBA, and MTBE together, however, did improve the prediction equation using RON, MON, and $(RON)^2$ terms (see Equation 39, Table E-II), as shown in Figure 9. The low standard deviation of 0.094 represents a substantial improvement over the equation with RON, MON, and $(RON)^2$. All six variables had highly significant effects. Toluene, TBA, and MTBE gave coefficients of 0.013, 0.032, and 0.031, respectively, which indicate 0.13, 0.32, and 0.31 Road ON boosts not accounted for by RON and MON (i.e., "bonuses") at 10 percent concentrations.

The inclusion of R-100, M-100 terms did not influence either the coefficients or the "goodness of fit."

Analysis made using all-car average Road ON's after sales-weighting each car did not change the correlation with RON and MON.

The best equation obtained for the part-throttle data is as follows:

$$\text{Part-Throttle Road ON} = 32.94 + 0.171(\text{RON}) + 0.449(\text{MON})$$

The standard deviation and R^2 for this equation are 0.336 Road ON and 0.938, respectively. Again, the coefficients calculated for the oxygenates were not significant (see Table E-III).

VIII. CALCULATION OF ROAD OCTANE PERFORMANCE (ROP)

The use of both laboratory octane numbers and oxygenate concentrations as independent variables in regressions on Road ON is undesirable because these variables are not independent. The concentration of oxygenate in each test fuel is highly correlated with the resulting RON and MON, relative to the base gasoline. To avoid this problem, a new dependent variable that included RON and MON was created to use in analyzing the oxygenate effects.

A Road ON equation was first developed for each test car for each gasoline grade using the three hydrocarbon fuels in each case. This was done for full-throttle data and part-throttle data (nine cars). The same was done using all six hydrocarbon fuels together (see Appendix F). It was found that the equations did not differ significantly between the two grades and, therefore, the six-fuel equations best represented the cars' Road octane performance with hydrocarbon fuels.

The new dependent variable, Road Octane Performance (ROP), was calculated by subtracting the predicted Road ON from the measured Road ON:

$$\text{ROP} = [\text{Measured Road ON}] - [\text{Predicted Road ON}]$$

or

$$\text{ROP} = [\text{Road ON}] - [a + b(\text{RON}) + c(\text{MON})]$$

This new variable represents the Road ON performance of the oxygenates as compared with hydrocarbon gasoline blending components. A positive value indicates a Road ON benefit, or "bonus"; a negative value indicates a deficit.

IX. AVERAGE RESULTS

Table IX presents the average Road ON and ROP for each test fuel for full-throttle and part-throttle test conditions. The latter averages represent only the nine cars that were tested at part-throttle. In the regular-grade fuels, the full-throttle ROP's for the oxygenate blends were generally positive, indicating improved performance relative to the base fuel which had an ROP of -0.25. No trend is readily apparent, however, in the premium fuels. The part-throttle data show roughly the same information, but the variations in ROP among the fuels appear to be much larger. Also, the Road ON's are much lower for part-throttle relative to full-throttle.

Table X presents the average Road ON and ROP for each test car for full-throttle, and for part-throttle where applicable. Among the full-throttle ROP's there are both positive and negative values, with an average of 0.02 Road ON -- essentially zero. The part-throttle average ROP was slightly negative at -0.09 Road ON. As with the averages for each fuel, the part-throttle Road ON's are generally lower than the full-throttle values, indicating that the part-throttle test is more severe.

X. ANALYSIS OF OXYGENATE EFFECTS

A. Nonlinearity of Oxygenate Effects

The effects of adding oxygenates to the base gasolines were evaluated using linear regression on every oxygenate/concentration level/grade/car combination. In each case, the dependent variable was ROP, and the independent variable was the oxygenate concentration. The results are shown in Appendix G for full-throttle data and in Appendix H for part-throttle data. Each effect is the regression coefficient for the oxygenate; it is a unit effect, i.e., the slope of the concentration curve at that concentration. The actual effect is determined by multiplying the unit effect by the portion of oxygenate added. If 10 percent were added, for example, the actual effect is one-tenth the unit effect.

TABLE IX

AVERAGE ROAD OCTANE NUMBERS AND ROAD OCTANE PERFORMANCE (ROP) FOR EACH FUEL

Fuel No.	Full Throttle* Road ON	Full Throttle* ROP	Part-Throttle** Road ON	Part-Throttle** ROP
	Premium Grade			
14	91.56	-0.05	87.44	0.02
15	92.77	-0.11	88.67	-0.06
16	92.20	-0.05	87.33	-0.67
17	92.62	-0.40	87.62	-1.07
18	92.31	0.03	86.91	-1.13
19	92.63	-0.20	88.59	0.06
20	92.23	0.11	87.37	-0.51
21	92.44	-0.29	88.46	0.01
22	92.03	0.11	87.71	0.01
23	92.42	0.26	87.93	0.00
24	92.32	0.14	88.22	0.12
25	93.02	0.10	88.14	-0.48
26	92.59	-0.26	87.62	-0.94
28	91.82	0.12	87.55	0.02
Average	92.35	-0.04	87.83	-0.33
	Regular Grade			
1	88.00	-0.25	84.27	-0.10
2	89.50	0.21	85.62	0.12
3	89.49	0.03	85.39	-0.08
4	90.39	0.17	86.35	-0.17
5	89.69	0.18	85.87	0.35
6	90.41	-0.05	86.26	-0.11
7	89.29	0.01	86.08	0.77
8	90.28	0.26	86.22	0.25
9	88.90	0.20	84.75	-0.03
10	89.18	0.10	85.50	0.37
11	89.55	0.23	85.46	0.13
12	90.52	0.38	86.10	0.00
13	90.15	0.23	86.06	0.16
27	88.67	0.07	84.64	0.00
Average	89.57	0.13	85.61	0.12

* Cars 23, 24, 25, 26, 28 and 34 are not included in averages because they did not test all fuels. Average standard deviation is 0.06 ON for Road ON and ROP.

**Cars 23 and 25 are not included in averages because they did not test Fuel 4. Average standard deviation is 0.13 ON for Road ON and ROP.

TABLE VIII

FULL-THROTTLE ROAD OCTANE REGRESSION EQUATIONS

All Car Averages: 38 Cars Road ON Mean = 90.792

Standard Deviation	R^2	Coefficients: Constant b_0	RON b_1	MON b_2	(R+M)/2 b_3	$(RON)^2$ b_4	Oxygenate
0.173	0.988	29.964	0.289	0.400			
0.176	0.988	32.481			0.655		
0.142	0.993	-103.107	3.165	0.378		-0.0153	
0.175	0.989	29.882	0.288	0.402			<u>0.006</u> Toluene
0.172	0.989	30.309	0.299	0.385			<u>-0.016</u> Methanol
0.175	0.989	29.943	0.292	0.397			<u>-0.009</u> Ethanol
0.177	0.988	29.883	0.289	0.401			<u>-0.004</u> Isopropanol
0.170	0.989	30.126	0.297	0.389			<u>0.018</u> TBA
0.164	0.990	30.852	0.300	0.377			<u>0.023</u> MTBE
0.173	0.989	29.504	0.285	0.410			<u>-0.016</u> MeOH/TBA

Note: All underlined coefficients were not significant at the 95% confidence level.

TABLE VII

AVERAGE FULL- AND PART-THROTTLE ROAD OCTANE NUMBERS

	FULL THROTTLE (38 CARS)				PART THROTTLE (9 CARS)			
FUEL NO.	MEAN	STD DEV	MIN	MAX	MEAN	STD DEV	MIN	MAX
1	87.797	1.501	85.0	91.0	84.322	2.191	81.4	87.6
2	89.421	1.541	86.6	92.6	85.767	1.942	82.6	88.6
3	89.361	1.595	85.7	92.1	85.622	2.199	82.9	89.2
4	90.147	1.684	86.4	93.0	86.211	2.048	83.8	89.8
5	89.471	1.540	85.5	92.0	85.444	2.626	82.2	90.0
6	90.258	1.736	86.9	93.6	86.478	2.054	83.8	90.2
7	89.074	1.461	85.7	91.6	86.189	2.151	82.4	89.6
8	90.042	1.771	84.8	92.8	86.400	1.997	84.2	89.6
9	88.695	1.463	95.2	91.6	84.800	2.993	79.6	88.6
10	88.958	1.766	84.8	91.8	85.711	2.290	82.1	88.8
11	89.329	1.659	84.6	92.0	85.611	2.307	82.6	89.0
12	90.321	1.726	85.4	93.5	86.244	2.141	83.0	90.0
13	89.889	1.843	85.4	92.8	86.267	2.162	83.8	89.5
14	91.411	1.865	86.8	95.2	87.578	2.353	84.6	92.2
15	92.655	2.204	88.6	97.3	88.511	2.185	86.2	92.0
16	92.116	2.029	88.2	95.9	87.467	2.073	85.2	91.2
17	92.495	2.280	86.2	97.6	88.100	2.294	85.0	91.7
18	92.063	2.286	86.4	96.4	87.178	2.306	84.4	91.7
19	92.524	2.176	88.5	97.3	88.778	2.487	85.7	92.6
20	92.024	2.070	87.6	95.8	87.589	2.948	83.8	92.0
21	92.387	2.011	88.4	97.1	88.422	2.479	85.6	92.6
22	91.842	2.020	87.4	95.6	87.800	2.403	84.4	92.1
23	92.363	1.823	88.5	96.0	88.178	2.701	85.0	92.2
24	92.213	2.201	87.1	96.4	88.333	2.301	85.2	92.2
25	92.803	2.359	87.6	97.3	88.444	2.568	85.4	92.5
26	92.387	2.353	87.4	97.2	87.844	2.545	85.4	91.8
27	88.539	1.783	84.6	92.0	84.833	3.084	80.4	88.6
28	91.592	1.828	86.6	95.4	87.889	3.383	84.5	92.8

NUMBER OF ESTIMATED RATINGS

FUEL	FULL THROTTLE	PART THROTTLE
4	5	2
15,17,19,21,25,26	1	0

TABLE VI

BLENDING OCTANE NUMBERS FOR OXYGENATES AND TOLUENE

Oxygenate	Average Conc. (Vol %)	Blending Octane Numbers RON	MON	R-100	M-100	Road ON
Premium Grade						
Ethanol	8.38	124.9	98.1	177.8	115.6	104.4
Ethanol	4.34	125.0	101.1	197.9	114.6	106.6
Isopropanol	9.25	117.8	98.0	155.7	108.4	101.7
Isopropanol	4.74	116.2	95.5	163.6	97.2	104.6
Methanol	9.80	126.7	96.2	176.6	112.2	102.1
Methanol	4.10	129.2	97.2	160.2	91.9	108.8
MTBE	9.56	118.1	101.7	149.4	117.0	105.9
MTBE	4.50	119.5	98.3	156.3	106.8	108.4
MeOH/TBA	4.78/4.92	115.7	101.5	156.8	117.6	101.2
TBA	8.72	104.3	94.2	121.7	96.1	102.7
TBA	4.46	106.3	94.0	123.3	107.0	101.4
Toluene	15*	110.4	94.3	102.6	84.6	99.6
Regular Grade						
Ethanol	8.90	137.8	105.4	190.2	123.9	115.8
Ethanol	4.80	138.4	108.9	210.9	128.1	122.6
Isopropanol	9.08	125.8	101.6	162.9	123.0	112.5
Isopropanol	4.40	129.3	109.1	174.4	130.0	116.9
Methanol	7.78	139.8	104.9	162.6	119.6	119.2
Methanol	4.34	146.0	107.1	164.0	114.6	123.7
MTBE	9.70	121.4	105.5	150.9	125.6	113.8
MTBE	4.86	127.5	106.5	151.8	129.6	119.3
MeOH/TBA	4.40/4.44	123.5	102.2	164.9	121.9	111.5
TBA	8.60	103.5	94.6	120.6	99.7	101.3
TBA	4.60	103.6	94.8	129.3	97.5	107.3
Toluene	15*	103.1	87.8	97.3	85.6	98.6

* Not Measured. Target value was 15% by volume.

TABLE V

TEST CARS

Make and Model	Disp., ℓ	Engine Type	No. Carb. Bbls	Trans. Type	No. Tested
General Motors					
Buick Century	3.0	V6	2	Auto	1
Buick LeSabre	5.0	V8	4	Auto	1
Buick Regal	3.8	V6	2	Auto	1
Buick Skylark	2.5	L4	TBI	Auto	1
Buick Skylark	3.8	V6	2	Auto	1
Chevrolet Caprice	4.4	V8	2	Auto	1
Chevrolet Cavalier	1.8	L4	2	Auto	3
Chevrolet Cavalier	1.8	L4	2	M-4	1
Chevrolet Chevette	1.6	L4	2	Auto	1
Chevrolet Celebrity	2.8	V6	2	Auto	2
Chevrolet Citation	2.5	L4	TBI	Auto	1
Chevrolet Impala	4.4	V8	2	Auto	1
Chevrolet Impala	3.8	V6	2	Auto	1
Oldsmobile Cutlass	3.8	V6	2	Auto	1
Pontiac J-2000	1.8	L4	2	Auto	1
Pontiac J-2000	1.8	L4	2	M-4	1
Pontiac 6000	2.8	V6	2	Auto	1
Ford					
Ford Escort	1.6	L4	2	Auto	3
Ford Escort	1.6	L4	2	M-4	3
Ford Futura	3.3	L6	1	Auto	1
Ford Futura	2.3	L4	2	Auto	1
Ford Granada	3.8	V6	2	Auto	1
Ford Mustang	2.3	L4	2	M-4	1
Mercury Zephyr	3.3	L6	1	Auto	1
Chrysler					
Dodge Aries	2.2	L4	2	M-4	1
Dodge Omni	2.2	L4	2	Auto	1
Plymouth Grand Fury	3.7	L6	1	Auto	1
Plymouth Reliant	2.2	L4	2	Auto	2
Imports					
Datsun 310	1.5	L4	2	Auto	1
Honda Civic	1.5	L4	3	M-5	1

TABLE IV

GAS CHROMATOGRAPHIC ANALYSES OF HYDROCARBON FUELS

(Percent by Volume)

Carbon Number	Olefins				Napthenes				Aromatics				Normal Paraffins				Iso-Paraffins			
	Fuel 1	Fuel 14	Fuel 27	Fuel 28	Fuel 1	Fuel 14	Fuel 27	Fuel 28	Fuel 1	Fuel 14	Fuel 27	Fuel 28	Fuel 1	Fuel 14	Fuel 27	Fuel 28	Fuel 1	Fuel 14	Fuel 27	Fuel 28
C_3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
C_4	0.4	0.5	1.1	0.2	-	-	-	-	-	-	-	-	3.3	2.5	1.2	3.0	0.4	0.3	0.5	0.2
C_5	2.7	2.9	5.8	1.8	0.3	0.2	0.4	0.1	-	-	-	-	3.6	2.7	3.7	1.8	9.8	9.1	10.4	8.0
C_6	1.8	1.8	3.6	0.7	2.2	1.4	2.6	0.6	0.7	0.6	1.0	0.5	1.7	0.9	1.4	1.0	8.2	7.0	7.5	6.3
C_7	0.8	0.9	1.9	0.1	3.0	1.5	3.0	0.4	2.6	15.6	4.9	2.4	1.3	0.6	0.9	0.7	5.6	4.5	6.0	4.6
C_8	0.4	0.2	0.6	-	2.9	1.6	1.8	1.7	6.1	7.4	8.8	8.6	0.9	0.4	0.5	0.5	18.6	14.0	4.3	26.5
C_9	-	-	-	-	1.0	0.6	0.8	0.5	7.3	6.8	9.9	13.4	0.7	0.4	0.4	0.7	3.0	3.0	3.5	4.1
C_{10}	-	-	-	-	-	-	-	-	4.5	5.3	6.1	6.2	0.2	0.2	0.3	0.2	1.5	1.3	1.3	1.6
C_{11}	-	-	-	-	-	-	-	-	1.4	1.4	2.3	1.0	0.2	0.1	0.2	0.1	0.1	0.1	0.2	0.1
C_{12}	-	-	-	-	-	-	-	-	-	-	0.1	0.1	0.2	0.1	0.4	-	-	-	-	-
TOTAL	6.1	6.3	13.0	2.8	9.4	5.3	8.6	3.3	22.7	37.1	33.1	32.2	12.2	8.0	9.0	8.0	47.3	39.2	33.7	51.4

TABLE III

ADDITIONAL FUEL PROPERTIES

Fuel	RVP, psi	ASTM D 86 Distillation, °F Percent Evaporated 10	30	50	70	90
1	8.0	134	180	228	268	340
2	6.9	144	193	228	256	335
3	10.5	112	174	224	263	334
4	10.0	118	152	223	266	340
5	8.5	126	161	224	266	340
6	8.4	126	149	217	261	339
7	8.0	130	167	224	267	342
8	7.7	132	156	214	261	339
9	8.1	132	170	223	266	341
10	7.9	132	164	214	261	337
11	7.7	135	176	223	265	339
12	7.5	133	169	214	263	344
13	9.3	118	154	215	261	338
14	7.0	144	197	237	270	341
15	5.5	155	208	235	257	335
16	9.5	118	188	232	266	338
17	9.7	121	135	231	264	336
18	7.5	132	181	234	267	339
19	7.5	133	154	230	264	337
20	6.9	137	180	232	265	337
21	6.9	137	164	226	262	335
22	6.9	140	184	232	266	337
23	6.8	141	178	228	265	338
24	6.6	142	189	231	265	338
25	6.6	141	180	225	263	338
26	8.8	124	162	225	263	336
27	7.5	131	171	228	293	367
28	6.3	147	212	251	286	336

TABLE II

TABULATION OF FUEL PROPERTIES

Fuel	Base Fuel	RON	MON	R-100	M-100	Concentration*, Volume % Toluene	Methanol	Ethanol	Isopropanol	TBA	MTBE	MeOH/TBA
1	A	88.4	81.8	88.0	82.3							
2	A	90.6	82.7	89.4	82.8	15.0						
3	A	90.9	82.9	91.3	83.7		4.34					
4	A	92.4	83.6	93.8	85.2		7.78					
5	A	90.8	83.1	93.9	84.5			4.80				
6	A	92.8	83.9	97.1	86.0			8.90				
7	A	90.2	83.0	91.8	84.4				4.40			
8	A	91.8	83.6	94.8	86.0				9.08			
9	A	89.1	82.4	89.9	83.0					4.60		
10	A	89.7	82.9	90.8	83.8					8.60		
11	A	90.3	83.0	91.1	84.6						4.86	
12	A	91.6	84.1	94.1	86.5						9.70	
13	A	91.5	83.6	94.8	85.8							4.40/4.44
14	B	95.1	85.0	91.9	84.6							
15	B	97.4	86.4	93.5	84.6	15.0						
16	B	96.5	85.5	94.7	84.9		4.10					
17	B	98.2	86.1	100.2	87.3		9.80					
18	B	96.4	85.7	96.5	85.9			4.34				
19	B	97.6	86.1	99.1	87.2			8.38				
20	B	96.1	85.5	95.3	85.2				4.74			
21	B	97.2	86.2	97.8	86.8				9.25			
22	B	95.6	85.4	93.3	85.6					4.46		
23	B	95.9	85.8	94.5	85.6					8.72		
24	B	96.2	85.6	94.8	85.6						4.50	
25	B	97.3	86.6	97.4	87.7						9.56	
26	B	97.1	86.6	98.2	87.8							4.78/4.92
27	C	90.7	80.7	90.0	81.2							
28	D	93.9	86.3	90.6	85.4							

* Except for the toluene blends, the values shown are averages of analyses submitted by five laboratories after rejecting outliers.

TABLE I

TARGET TEST FUEL SPECIFICATIONS

Octanes

Meet the octanes specified below for Fuels 1, 14, 27, and 28.

Fuel 1:	(R+M)/2 = 85-86	RON-MON = 6.5-7.5
Fuel 14:	(R+M)/2 = 89.5-90.5	RON-MON = 10-11
Fuel 27:	(R+M)/2 = 85-86	RON-MON = 9.5-10.5
Fuel 28:	(R+M)/2 = 89.5-90.5	RON-MON = 7-8

Oxygenates and Toluene

Meet the specified contents within $\pm0.5\%$ by volume. Methanol must be anhydrous. Ethanol must be at least 198-proof CDA-19 or CDA-20. Isopropyl alcohol, tertiary butyl alcohol, and methyl tertiary butyl ether must not contain more than 1% water.

Water Tolerance and Cleanliness

Final blends must be clean and bright, and they must not form water haze or droplets when chilled to 32°F. These inspections should be made on samples taken from 5-gallon cans prepared for shipping.

Volatility - All Fuels

Reid Vapor Pressure	- 7-11 lb*
ASTM D 86 Distillation	
IBP	- 90°F Minimum
10% Evaporated	- 110-150°F
30% Evaporated	- 140-195°F
50% Evaporated	- 180-250°F
70% Evaporated	- 220-300°F
90% Evaporated	- 285-370°F
EP	- 450°F Maximum

* Fuels 27 & 28 - 8 lb maximum RVP.

Hydrocarbon Composition

Fuels 1 and 14 must be typical of unleaded regular and premium gasolines produced in the U.S. Fuels 1, 14, 27, and 28 must be blended with normal refinery components.

Other

Total Aromatics Content		Lead Content	- 0.03 μg/gal max.
Fuel 1	- 20-30%	Sulfur Content	- 0.05% maximum
Fuel 14	- 30-40%	Manganese	- None to be added
Total Olefins Content	- 5-10%	Antioxidant	- 5 PTB (100% active)
Benzene Content	- 1% Max.	Blending Components	- Normal refinery components

T A B L E S

AND

F I G U R E S

XI. FUTURE PROGRAMS

This program evaluated the effects on Road octane performance of adding six oxygenates to a premium and a regular base gasoline. In addition, it studied the influence of concentration level, transmission type, and engine type. The results are useful but they raise at least two questions:

- Why were the results quite different between the two grades?
- What are the shapes of the curves of response versus oxygenate concentration?

To answer the first question, a test program would have to include a number of base gasolines, as well as at least two oxygenates. The test fuels would have to be designed to independently evaluate octane level and hydrocarbon composition, i.e., the distribution of octane quality across the boiling range. To answer the second question, several oxygenate concentrations would be required. It is recommended that a test program be conducted in the near future to answer these questions.

F. Oxygenate Concentration Level Effects

Table XV shows average oxygenate effects and significance for each concentration level for each grade. Neither level was significant in the premium fuels, but both levels were highly significant in the regular fuels. In both grades, the low concentration level had the largest effect; however, the difference was not significant with the premium fuels. Figures 15 and 16 show the effects for both concentrations of each oxygenate. In all but one case, t-butanol in premium gasoline, the effect was larger at the low concentration.

G. Summary of Oxygenate Effects Results

Because of the non-linearity in the oxygenate response, the low- and high-concentration data were analyzed separately. The premium and regular grade fuels were analyzed separately because the results differed considerably between the two grades. The performance of the six oxygenates was about the same within each of the two grades. Only three of the premium grade oxygenate/concentration combinations were highly significant, but ten of the eleven regular-grade combinations were highly significant.

The oxygenate effects varied considerably among the engine types, but the average effects were significant for only the L6 and V6 engines in the regular grade fuels. The unit oxygenate effects were larger for the low concentration than the high concentration in the regular fuels. The overall average effects for the two concentrations were significant in only the regular fuels.

These results may be open to question because of the use of ROP rather than Road ON as the dependent variable. Because the ROP's are based on only six hydrocarbon fuels, the individual calculated oxygenate effects may be slightly high or low, or they all might be slightly biased upward or downward. Also, this method does not allow evaluating possible side effects of octane level on oxygenate performance within each gasoline grade. The ROP method, however, provided the only way to evaluate oxygenate performance independent of RON and MON, and the results are supported by other results in this report.

The Road ON equation study showed TBA and MTBE to have Road octane benefits independent of RON and MON. This is what the ROP analysis would have shown if the regular and premium-grade data were combined, as in the equation study. Also, the oxygenate blending octane number data showed relatively high values for Road ON, particularly in he regular grade. Another supporting finding is that the ROP results are not sensitive to variations in the Road ON equations used in calculating ROP. Using all twenty-eight fuels to develop the Road ON equations produced similar results, although the effects were generally a little smaller.

C. Oxygenate Effects

Full-throttle results are presented in Table XII. Oxygenate effects and significance are shown for the two grades, the six oxygenates, and the two concentration levels. Each effect is a unit effect, i.e., the theoretical effect of adding 100 percent of the oxygenate. In the premium grade fuels the statistically significant effects were methanol and t-butanol at the high concentration level. T-butanol had a beneficial effect of 4.97; methanol had an adverse effect of -3.69. Methanol/TBA had an adverse effect of -2.62, but the significance was slightly less than 90 percent.

In the regular grade fuels, all oxygenates except ethanol at the high concentration had highly significant effects. All effects were positive, indicating that the oxygenates were beneficial; they produced higher Road ON's than hydrocarbon blending components, at the same RON and MON.

Table XIII shows the part-throttle average oxygenate effects and significance for each oxygenate and each grade. The only significant effects were methanol/TBA in premium gasolines and IPA in regular gasolines, even though the effects were generally large. The small number of significant effects was probably due to the limited number of cars and to the poorer repeatability of the part-throttle test.

D. Gasoline Grade Effects

The oxygenate effects for the premium and regular gasolines are compared in Figure 12. The premium gasoline effects are considerably lower in every case than the regular gasoline effects. Three possible causes are the differences in the hydrocarbon composition of the two base gasolines, the differences in test fuel octane level, and the large differences in spark advance required.

E. Engine Type Effects

Table XIV shows average oxygenate effects and significance for each engine type for each grade. Although the premium-grade effects were not significant, there were two highly significant regular-grade effects; the L6 engines as a group showed the very large beneficial effect of 23.32, and the V6 engines showed an 11.77 effect. The only significant difference among the engine types, in the premium fuels, was that the V8 engines' effect was lower than those of the other engines. In the regular fuels, the L6 engines had larger effects, and the L4 engines had smaller effects than the other engines. The effects are presented graphically in Figures 13 and 14 for both low and high concentrations.

The full-throttle oxygenate effects are plotted versus concentration in Figures 10 and 11 for premium- and regular-grade gasolines, respectively. In all but one case the unit effect was less at the high concentration than at the low concentration. In fact, two of the oxygenates had effects that went from positive to negative as the concentration was increased, in the premium base gasoline. Because the response was different at the two concentration levels, the oxygenate effects were evaluated at both levels rather than averaging the two levels.

B. Analysis of Variance (ANOVA)

ANOVA's were used to determine what variables had significant effects. ANOVA's were conducted on the full-throttle oxygenate effects for premium and regular grades separately, and on the part-throttle data with the two grades combined. This was done because the full-throttle results were quite different in the two grades. Several car design parameters were evaluated to see if they affected ROP: transmission types (automatic or manual); engine types (cylinder configuration); engine model; and car model. Only engine type was retained for further analysis, because the others showed little or no influence on ROP. The fuel variables studied were oxygenate, oxygenate concentration, and gasoline grade. Table XI gives a summary of significance level for the main effects and interactions.

The low significance levels for the oxygenate variable in the full-throttle portion of Table XI indicate that there were no statistically significant differences among the oxygenates in either grade. There were large and significant differences, however, among the four engine types -- L4, L6, V6, and V8. The only other highly significant variable was oxygenate concentration level (i.e., the low level or the high level) in the regular grade fuels. This verifies the visually observed nonlinearity in these results. There appeared to be an interaction between engine type and concentration level in both grades, although the significance levels were less than 90 percent.

The part-throttle ANOVA showed the grade variable to be highly significant, meaning that the oxygenate effects differed between the two grades. The oxygenate variable was not highly significant, but the grade/concentration level interaction significance was nearly 90 percent.

Based on these ANOVA's, variables were selected for presentation and discussion in the following sections.

TABLE X

AVERAGE ROAD OCTANE NUMBERS AND ROAD OCTANE PERFORMANCE (ROP) FOR EACH CAR

Car No.	Full Throttle* Road ON	Full Throttle* ROP	Part-Throttle* Road ON	Part-Throttle* ROP
1	90.30	0.08		
2	91.21	0.14		
3	91.81	0.20		
4	89.39	0.20		
5	92.79	0.49	85.89	-0.31
6	92.29	-0.25	86.88	-0.17
7	90.73	-0.17	84.29	0.15
8	91.27	0.20		
9	93.17	0.21		
10	90.43	-0.59		
11	88.96	-0.14		
12	89.01	0.13		
13	90.56	-0.03		
14	91.10	-0.22		
15	93.49	0.15		
16	91.61	-0.09		
17	91.89	0.22		
18	90.65	0.04		
19	92.32	0.22		
20	88.72	0.15		
21	89.23	-0.06		
22	89.98	0.05		
23	88.86	-0.21	84.46	0.37
24	86.96	-0.29		
25	92.08	0.34	88.05	0.00
26	90.13	-0.12		
27	89.37	-0.14	87.38	-0.47
28	87.28	-0.15		
29	91.14	0.42		
30	92.51	0.17		
31	93.88	-0.47		
32	91.03	0.41		
33	91.51	0.15		
34	93.15	-0.09		
35	89.02	0.21	89.57	-0.61
36	90.73	-0.00	90.27	0.24
37	88.85	-0.16	84.11	0.01
38	92.52	-0.19		
Average	90.79	0.02	86.77	-0.09

* Fuel 4 was not tested in five cars; therefore, it is not included. Car 34 is not comparable to others because six fuels were not tested.

TABLE XI

SIGNIFICANCE OF THE VARIABLES

Variable	Significance, % Premium	Significance, % Regular
Full-Throttle		
Oxygenate	65.7	30.0
Engine Type	98.8	99.9
Oxygenate Concentration	78.1	99.9
Oxygenate X Engine Type	0.7	0.4
Oxygenate X Oxygenate Concentration	51.6	37.5
Engine Type X Oxygenate Concentration	83.1	84.4

Variable	Significance, % Both Grades
Part-Throttle	
Oxygenate	67.1
Grade	99.9
Oxygenate Concentration	41.0
Oxygenate X Grade	42.5
Oxygenate X Oxygenate Concentration	53.3
Grade X Oxygenate Concentration	89.1

TABLE XII

OXYGENATE AND CONCENTRATION EFFECTS

Oxygenate	Concentration Level	Unit Effect*	Significance, %
	Premium Grade		
Ethanol	High	-1.42	65.4
Ethanol	Low	-0.68	15.4
Isopropanol	High	-1.64	68.9
Isopropanol	Low	2.31	54.6
Methanol	High	-3.69	92.5
Methanol	Low	1.44	33.5
MTBE	High	1.19	55.0
MTBE	Low	3.95	74.8
Methanol/TBA	High	-2.62	88.4
TBA	High	4.97	99.9
TBA	Low	3.06	75.1
	Regular Grade		
Ethanol	High	2.85	87.9
Ethanol	Low	8.24	99.7
Isopropanol	High	5.03	99.8
Isopropanol	Low	5.67	95.9
Methanol	High	5.39	98.1
Methanol	Low	7.34	98.3
MTBE	High	6.51	99.9
MTBE	Low	9.53	99.9
Methanol/TBA	High	4.64	99.4
TBA	High	3.96	96.8
TBA	Low	9.82	99.9

* Unit effect is the slope of the concentration curve at that concentration.

TABLE XIII

OXYGENATE EFFECTS AT PART THROTTLE

Oxygenate	Unit Effect*	Significance, %
	Premium Grade	
Ethanol	-11.41	72.6
Isopropanol	- 5.75	67.2
Methanol	-12.04	78.5
MTBE	0.67	11.3
Methanol/TBA	- 9.18	94.6
TBA	- 0.65	11.0
	Regular Grade	
Ethanol	1.54	26.4
Isopropanol	13.58	90.6
Methanol	5.13	64.8
MTBE	4.62	75.4
Methanol/TBA	5.36	79.4
TBA	4.43	67.3

* Unit effect is the slope of the concentration curve at that concentration.

TABLE XIV

ENGINE TYPE EFFECTS

Engine Type	Unit Effect*	Significance, %
	Premium Grade	
L4	-0.38	12.8
L6	4.20	34.6
V6	3.92	72.3
V8	-4.74	59.2
	Regular Grade	
L4	1.74	69.3
L6	23.32	96.2
V6	11.77	98.8
V8	7.61	75.9

* Unit effect is the slope of the concentration curve at that concentration.

TABLE XV

OXYGENATE CONCENTRATION LEVEL EFFECTS

Concentration Level	Unit Effect*	Significance, %
	Premium Grade	
High	-0.47	29.0
High**	-0.07	4.1
Low	2.02	57.1
	Regular Grade	
High	4.68	99.8
High**	4.72	99.8
Low	8.12	99.9

* Unit effect is the slope of the concentration curve at that concentration.

** Methanol/TBA is not included in the averages, so that the results are comparable to the low concentration level results.

FIGURE 1

TEST FUEL DESIGN

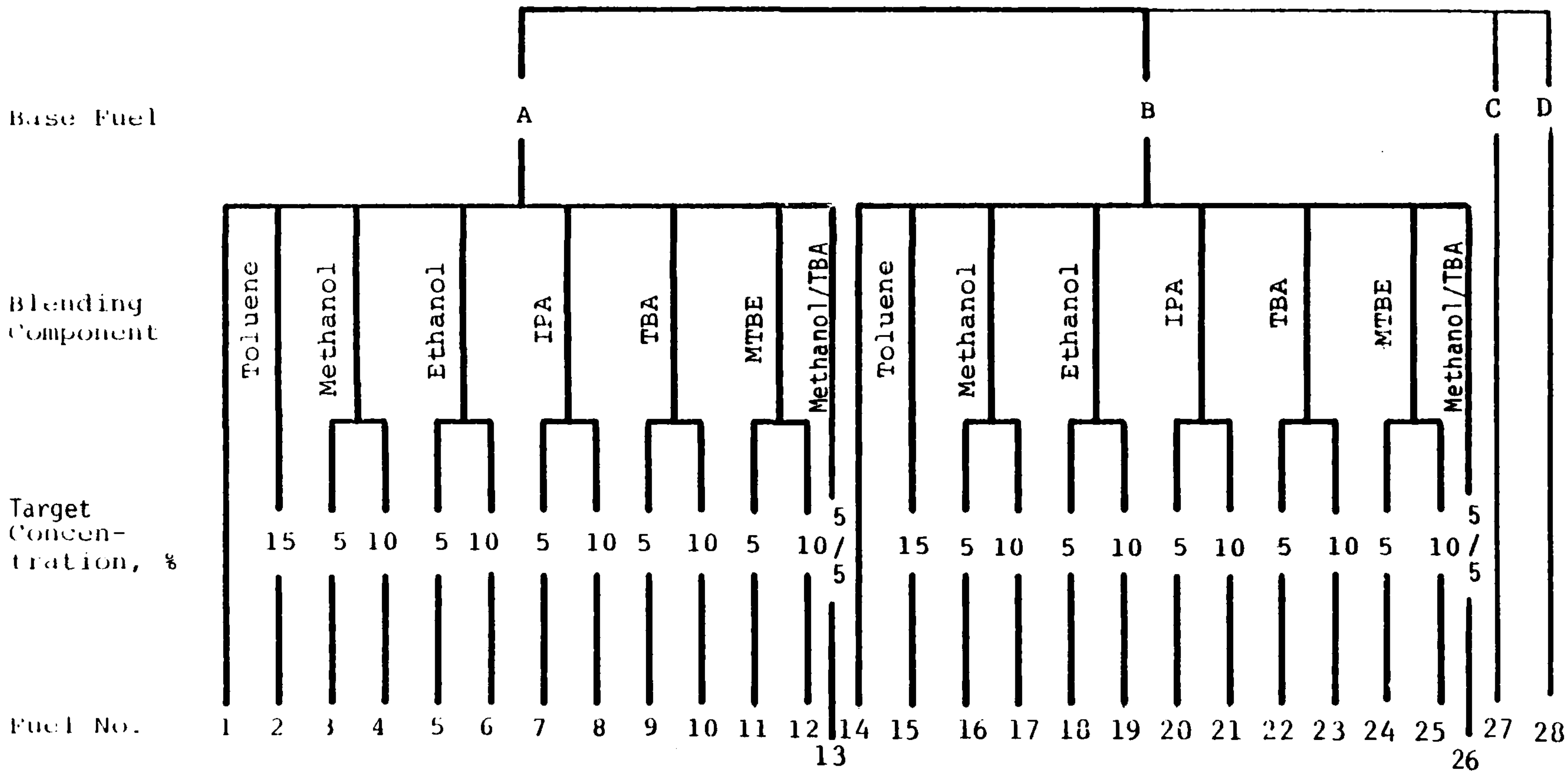


FIGURE 2

EFFECT OF CONCENTRATION ON ROAD BLENDING OCTANE NUMBER

GRADE=PREMIUM

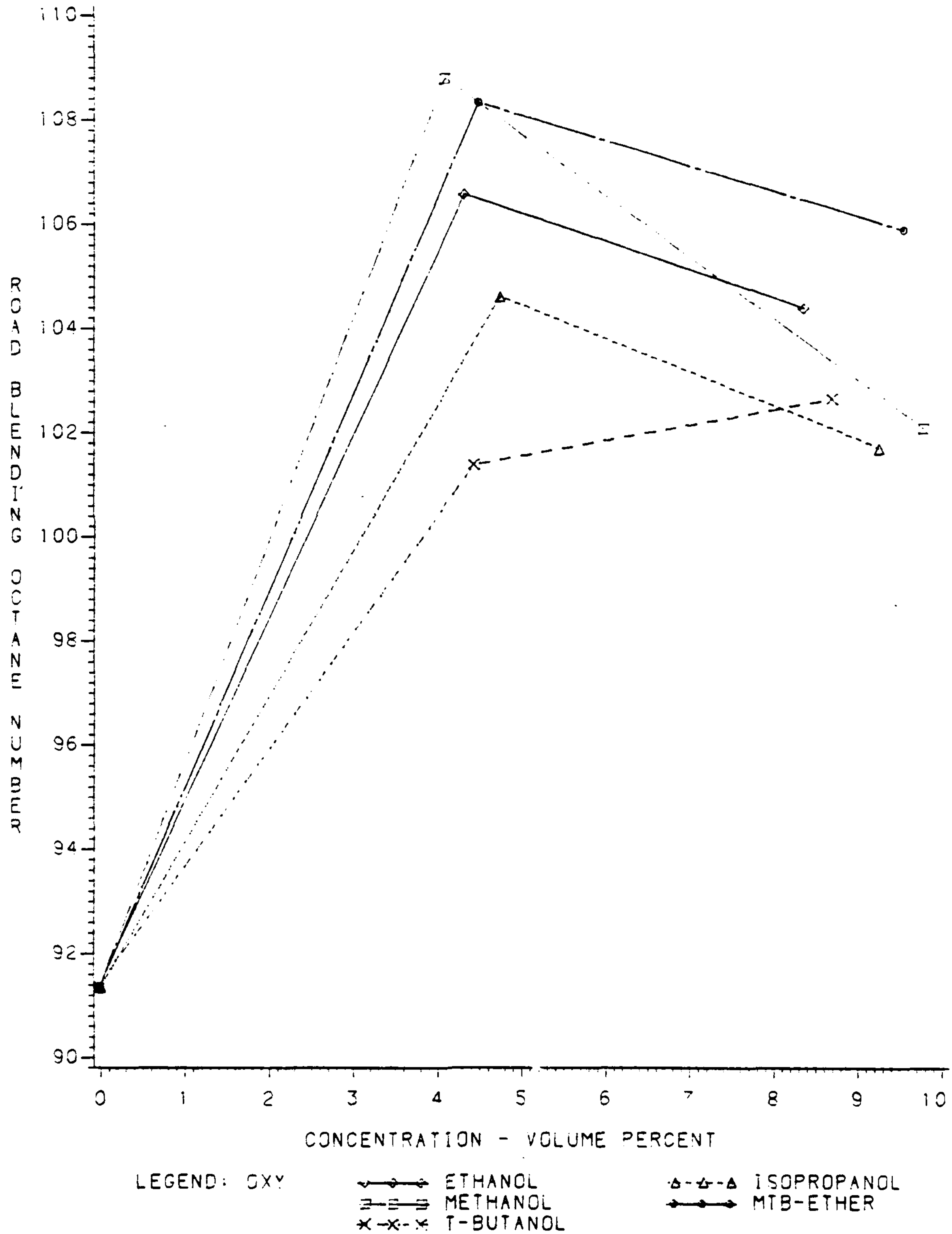


FIGURE 3

EFFECT OF CONCENTRATION ON ROAD BLENDING OCTANE NUMBER

GRADE=REGULAR

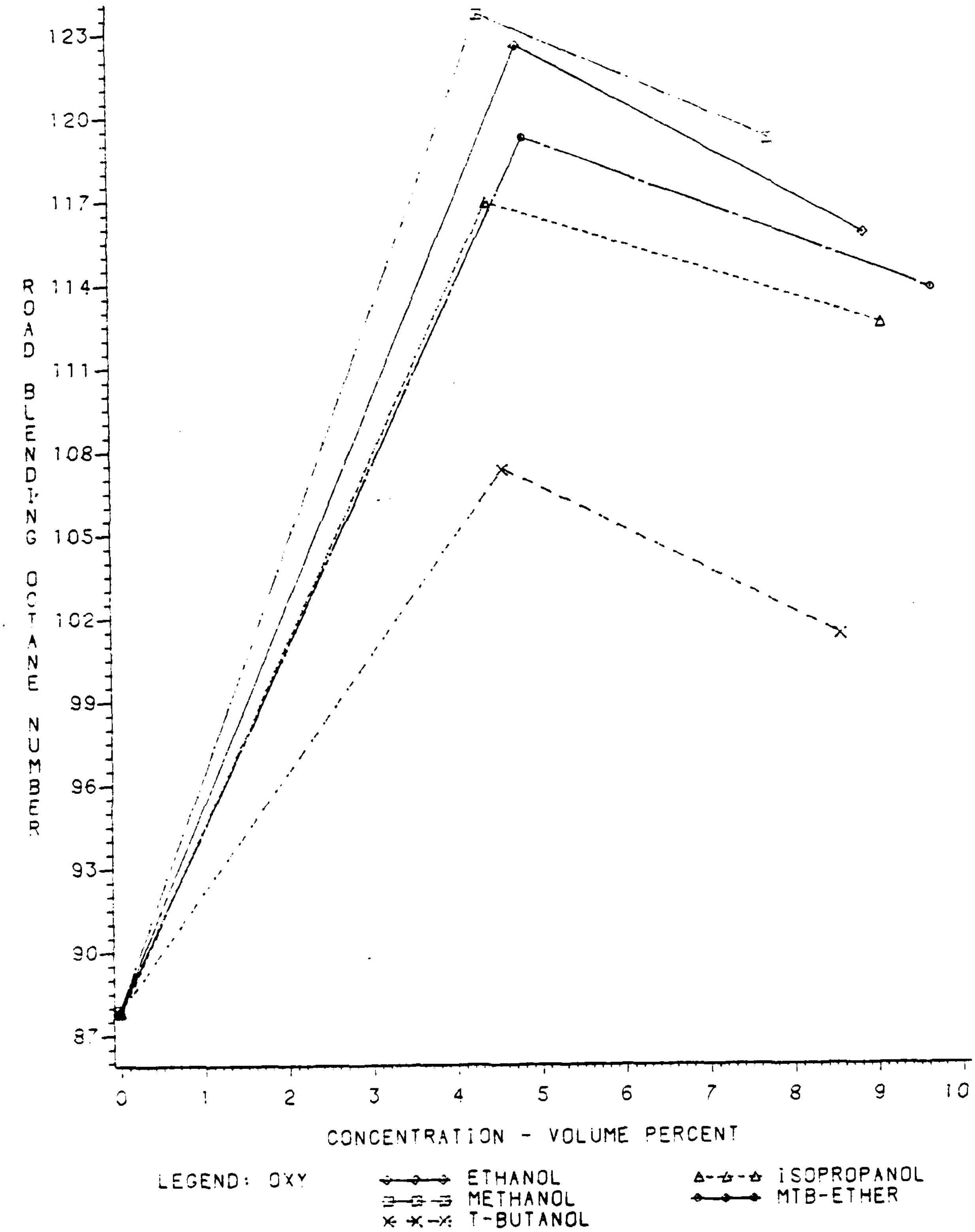


FIGURE 4

BLENDING ROAD OCTANE NUMBERS FOR PREMIUM AND REGULAR GRADE

AVERAGE CONCENTRATION

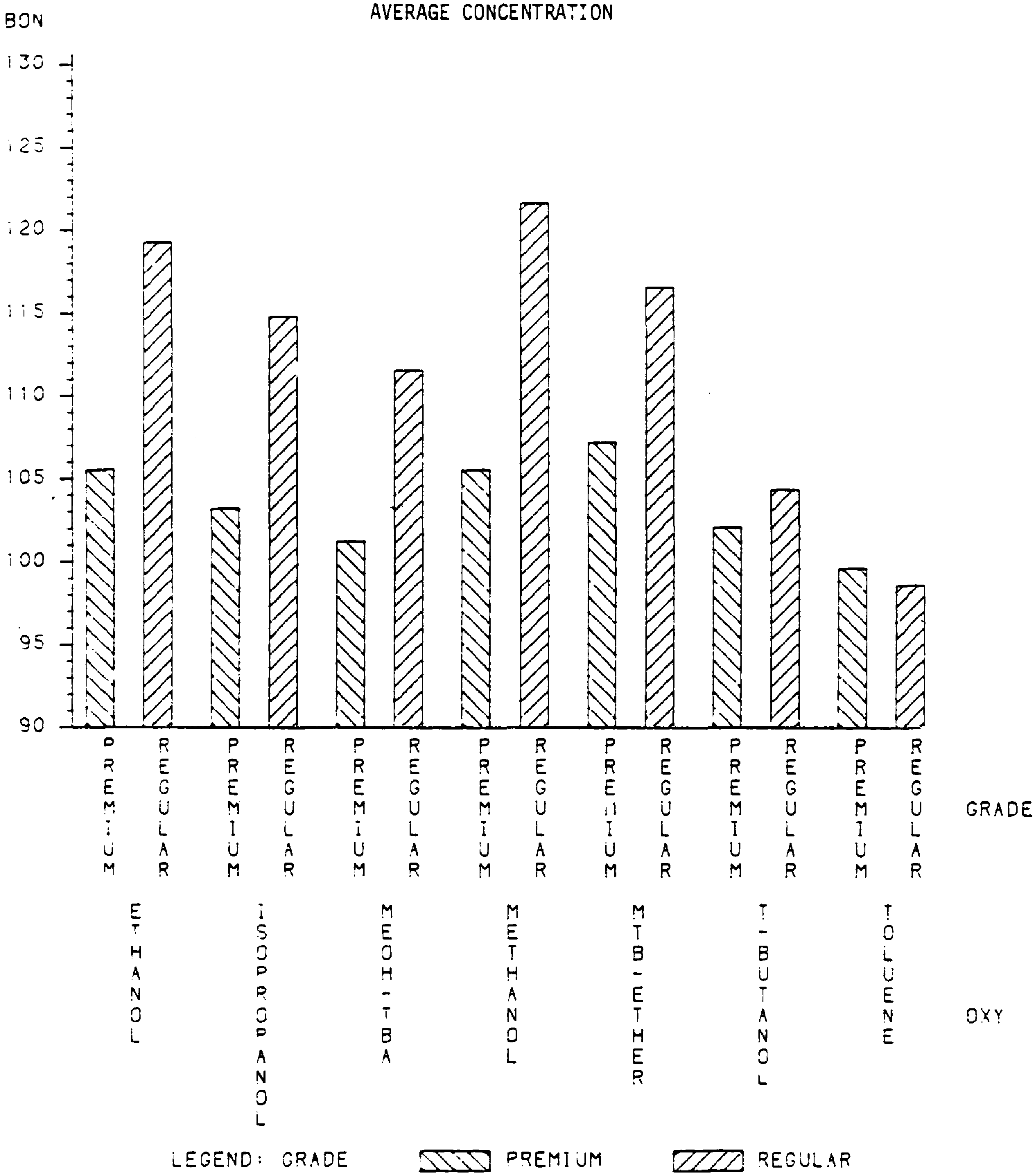


FIGURE 5

BLENDING OCTANE NUMBERS FOR LABORATORY AND ROAD TESTS

GRADE=PREMIUM

AVERAGE CONCENTRATION

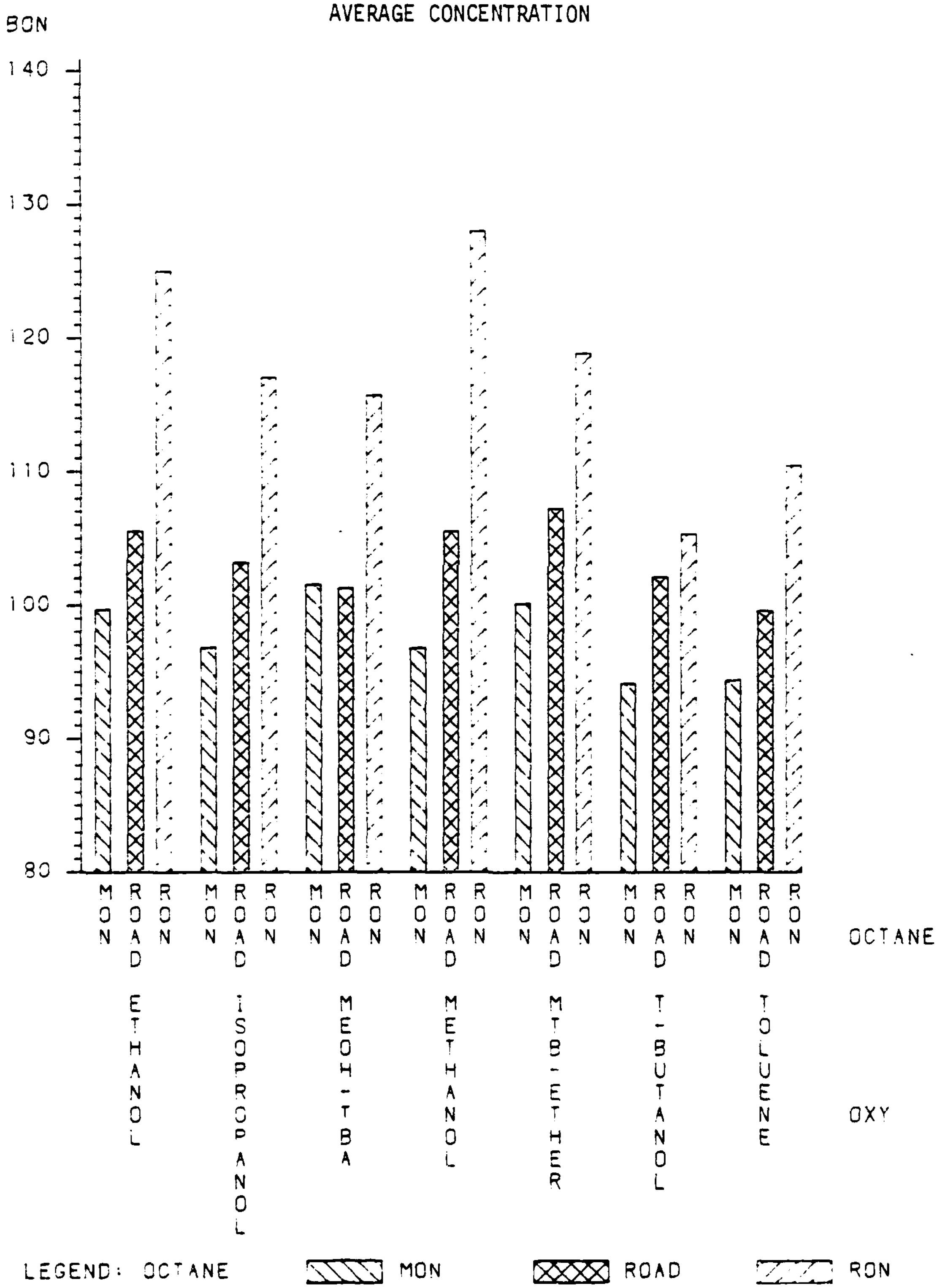


FIGURE 6

BLENDING OCTANE NUMBERS FOR LABORATORY AND ROAD TESTS

GRADE=REGULAR

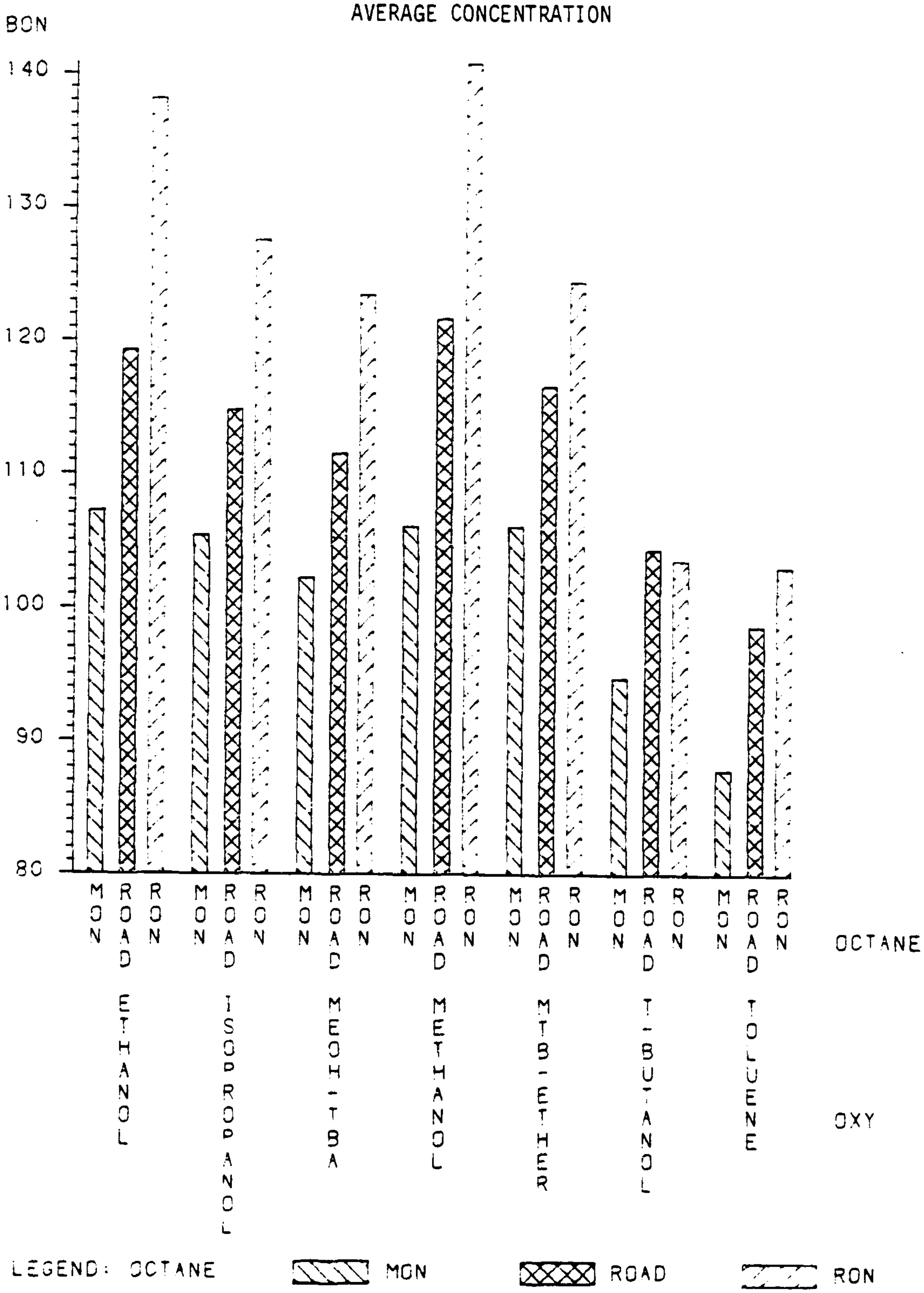
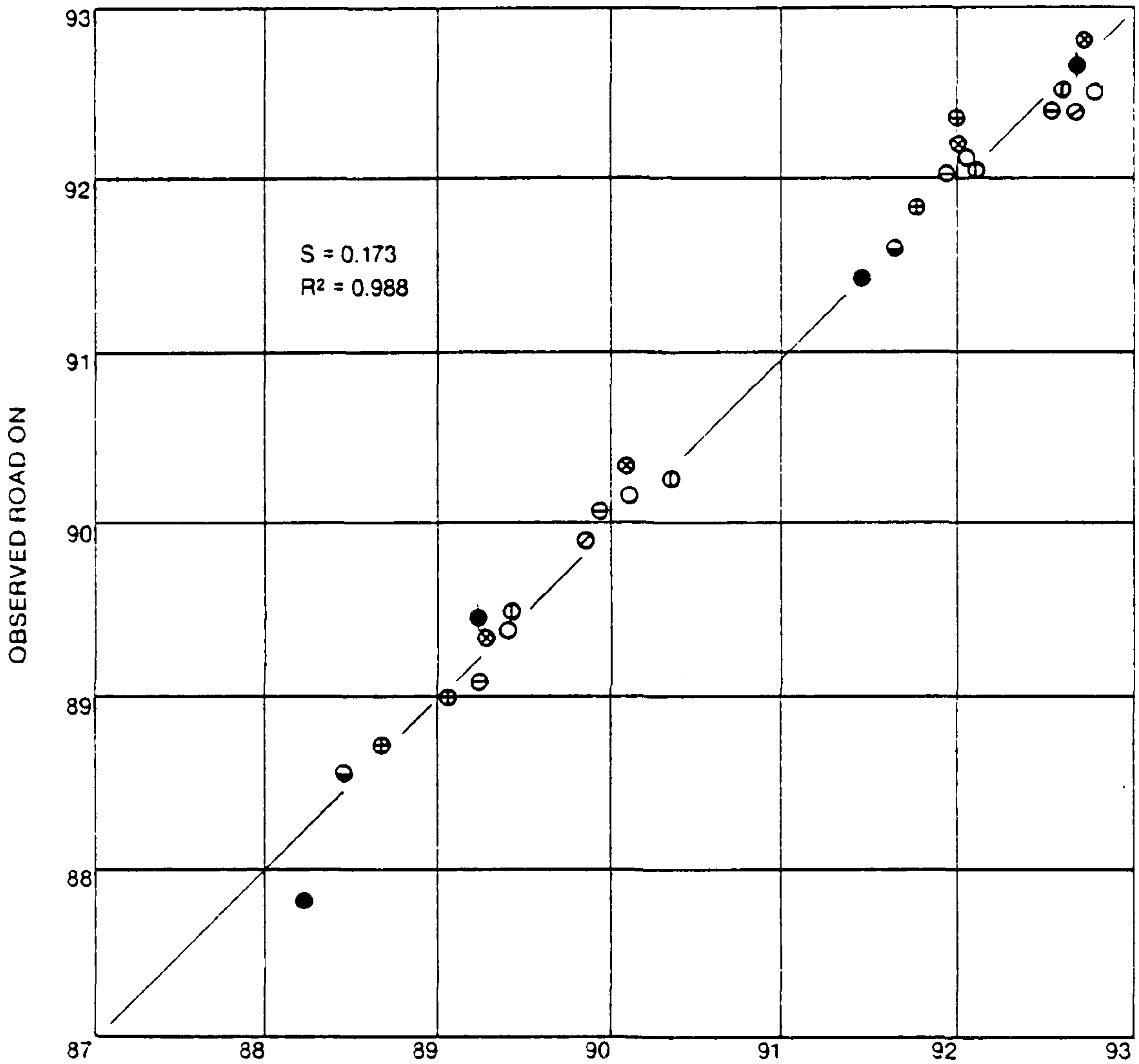


Figure 7

PREDICTION OF 38-CAR AVERAGE FULL-THROTTLE
ROAD ON BY RON, MON EQUATION
All Cars Tested



PREDICTED ROAD ON

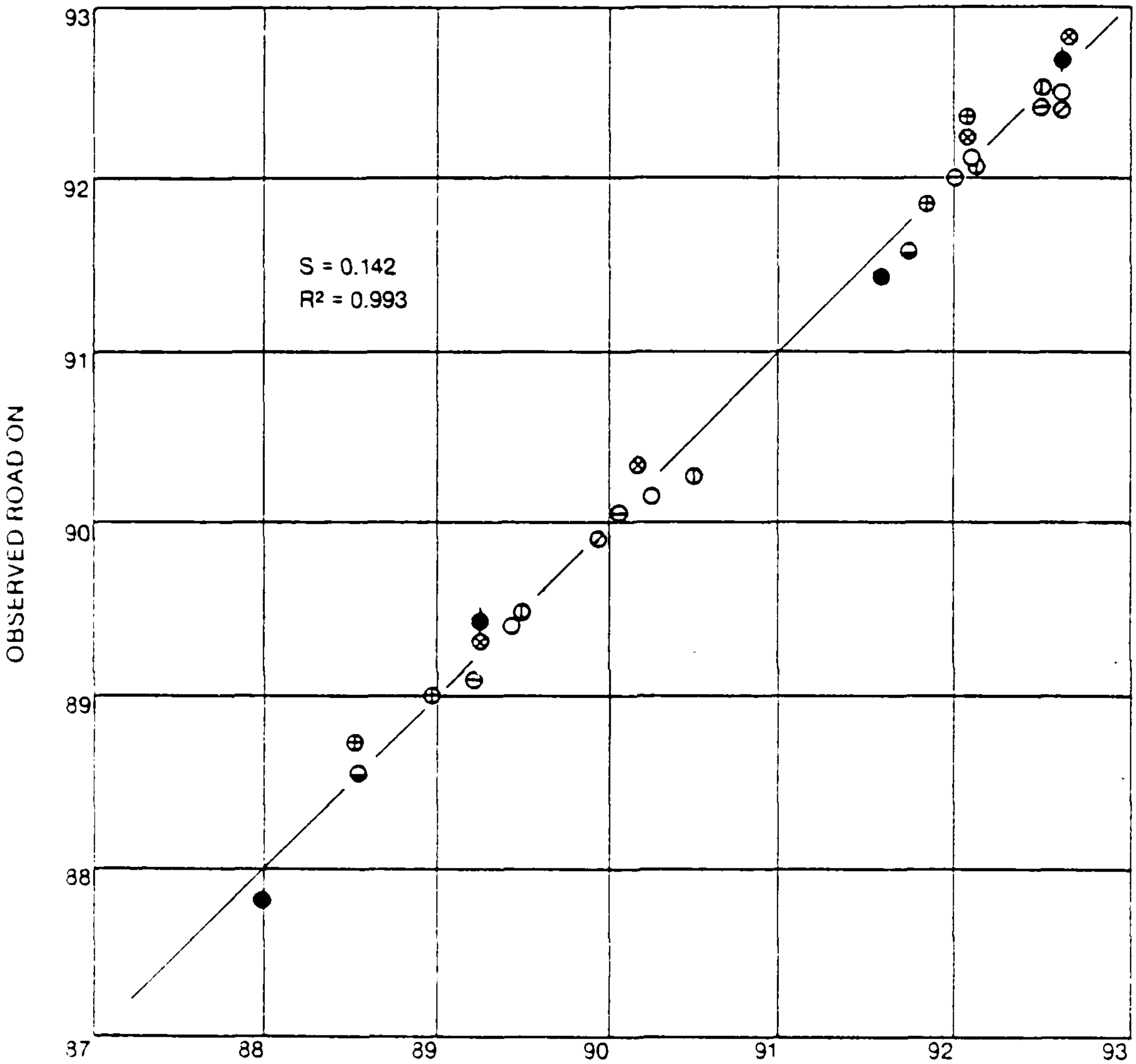
ROAD ON = 29 964 + 0.289 RON + 0.400 MON

LEGEND

Base Hydrocarbon Fuels	●
Base Fuels + 15% Toulene	●
Other Hydrocarbon Fuels (Numbers 27 and 28)	◒
Base Fuel + Methanol	○
Base Fuel + Ethanol	⦶
Base Fuel + Isopropanol	⊖
Base Fuel + Tertiary Butanol	⊕
Base Fuel + Methyl Tertiary Butyl Ether	⊗
Base Fuel + Methanol/Tertiary Butanol	⊘

Figure 8

PREDICTION OF 38-CAR AVERAGE FULL-THROTTLE ROAD ON BY RON, MON, $(RON)^2$ EQUATION
All Cars Tested



PREDICTED ROAD ON

$$\text{ROAD ON} = -103.187 + 3.165\ \text{RON} + 0.378\ \text{MON} - 0.0153\ (\text{RON})^2$$

LEGEND

Base Hydrocarbon Fuels	●
Base Fuels + 15% Toulene	●
Other Hydrocarbon Fuels (Numbers 27 and 28)	◒
Base Fuel + Methanol	○
Base Fuel + Ethanol	⦶
Base Fuel + Isopropanol	⊖
Base Fuel + Tertiary Butanol	⊕
Base Fuel + Methyl Tertiary Butyl Ether	⊗
Base Fuel + Methanol/Tertiary Butanol	⊘

1982 FUEL RATING PROGRAM
ROAD OCTANE PERFORMANCE OF OXYGENATES

I. Introduction

Road octane rating programs have been conducted periodically by the CRC Motor Road Test Group to investigate the relationship between the laboratory properties of a set of motor gasolines and the road anti-knock performance of these fuels in a selected group of cars. The programs of 1971, 1973, 1975, and 1978 tested unleaded gasolines with a wide range of Research octane number (RON), Motor octane number (MON), and sensitivity. Variables evaluated were RON, MON, aromatics content, and olefins content. The testing was done by Road Test Group participants from the oil and automobile industries at their own laboratories. The last program, conducted in 1980, evaluated heavy aromatics content and ethanol content in addition to Research and Motor octane numbers. Because of the widespread interest in the use of alcohols and ethers as gasoline blending components, the proposed program for 1982 will evaluate several oxygenates.

The 1980 program revealed a large variation among cars and car models in their response to the test gasolines. Most of the 37 cars tested showed an adverse effect of adding heavy aromatics, and some of the cars showed beneficial effects for ethanol in the gasolines. It is believed that each engine type and transmission type is affected in a different way by the gasoline variables. The proposed 1982 program will investigate these car design features as well as the effects of oxygenates.

II. Objectives

In terms of the fuels, the main objective is to determine the effect on Road ON of each of five oxygenates--methanol, ethanol, isopropanol, tertiary butyl alcohol, and methyl tertiary butyl ether--independent of their effects on RON and MON. This will be done in two base gasolines, one at the regular unleaded gasoline octane level and the other at the premium unleaded gasoline octane level. Blending octane numbers will also be determined for the oxygenates.

The second objective is to evaluate the effects of engine and transmission type on the effects of the oxygenates. Up to one-half of the test cars will be used in a test design for this purpose.

III. Test Cars

The target is to test about 40 1982-model U.S. and imported cars. Subsets of the cars will be selected to evaluate the effects of engine and transmission types. For example, car Model X could be tested with four-cylinder engine and manual transmission, with four-cylinder engine and automatic transmission, with six-cylinder engine and manual transmission, and with six-cylinder engine and automatic transmission.

1982 FUEL RATING PROGRAM
ROAD OCTANE PERFORMANCE OF OXYGENATES

Table of Contents

COORDINATING RESEARCH COUNCIL
INCORPORATED
219 PERIMETER CENTER PARKWAY
ATLANTA, GEORGIA 30346
(404) 396-3400

Not to be Published

1982 FUEL RATING PROGRAM

ROAD OCTANE PERFORMANCE OF OXYGENATES

CRC Project No. CM-124-82

August 1981

A P P E N D I X   B

PROGRAM

PARTICIPATING LABORATORIES

Amoco Oil Company
Ashland Petroleum Company
Chevron Research Company
Gulf Research and Development Company
Mobil Research and Development Corporation
Shell Development Company
Standard Oil Company (Ohio)
Sun Tech, Inc.
Texaco Inc.
Union Oil Company of California

CRC ANALYSIS PANEL

J. C. Ingamells, Leader	Chevron Research Company
D. P. Barnard	Standard Oil Company (Ohio)
E. S. Corner	Consultant
R. E. Dizak	Gulf Research and Development Company
G. H. Schafer	Texaco Inc.
J. F. Wickey	Shell Development Company
W. K. Wong	Mobil Research and Development Corp.

APPENDIX A

PARTICIPATING LABORATORIES

AND

MEMBERSHIP OF ANALYSIS PANEL

FIGURE 16

OXYGENATE EFFECTS FOR LOW AND HIGH CONCENTRATIONS

GRADE=REGULAR

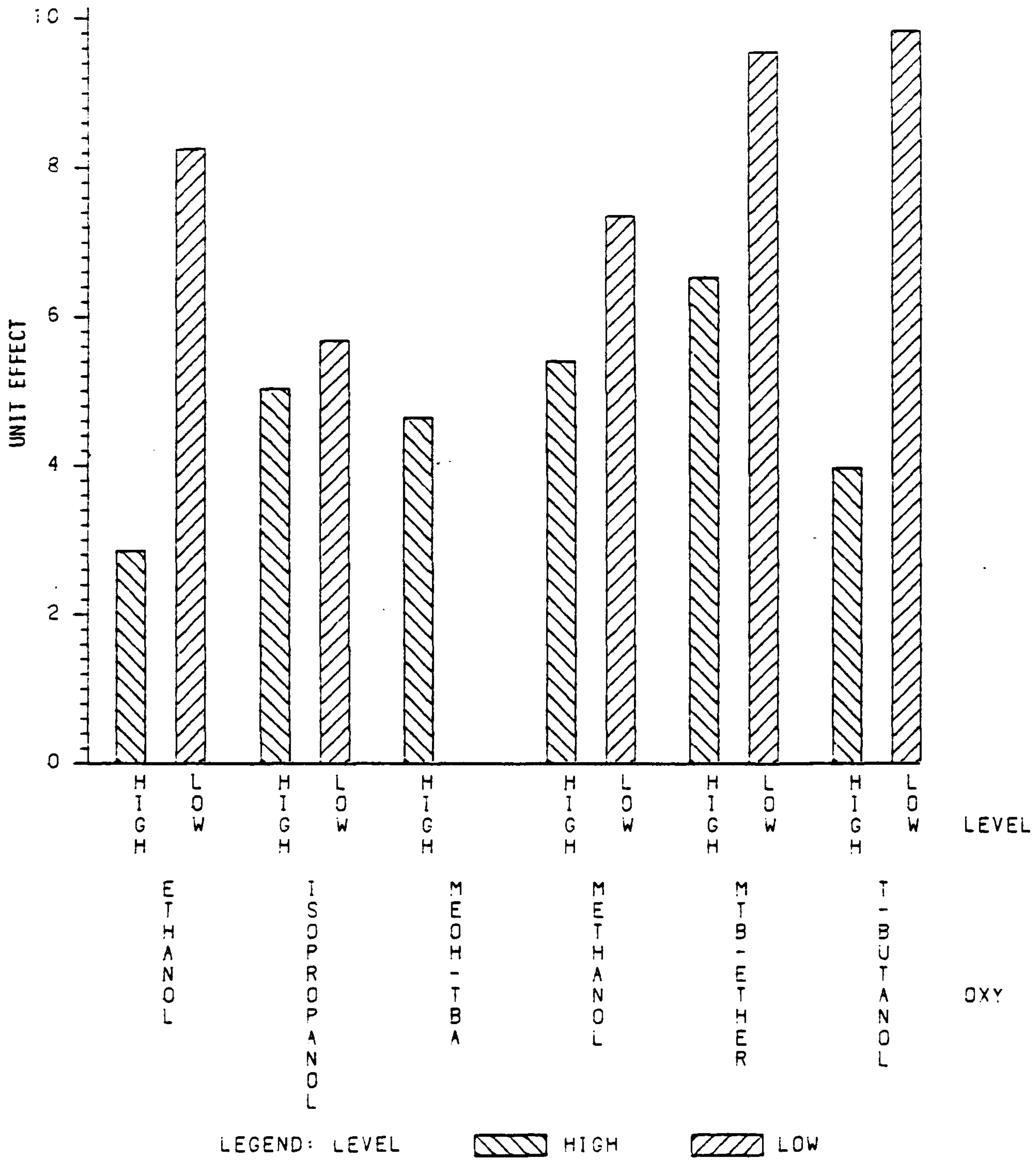


FIGURE 15

OXYGENATE EFFECTS FOR LOW AND HIGH CONCENTRATIONS

GRADE=PREMIUM

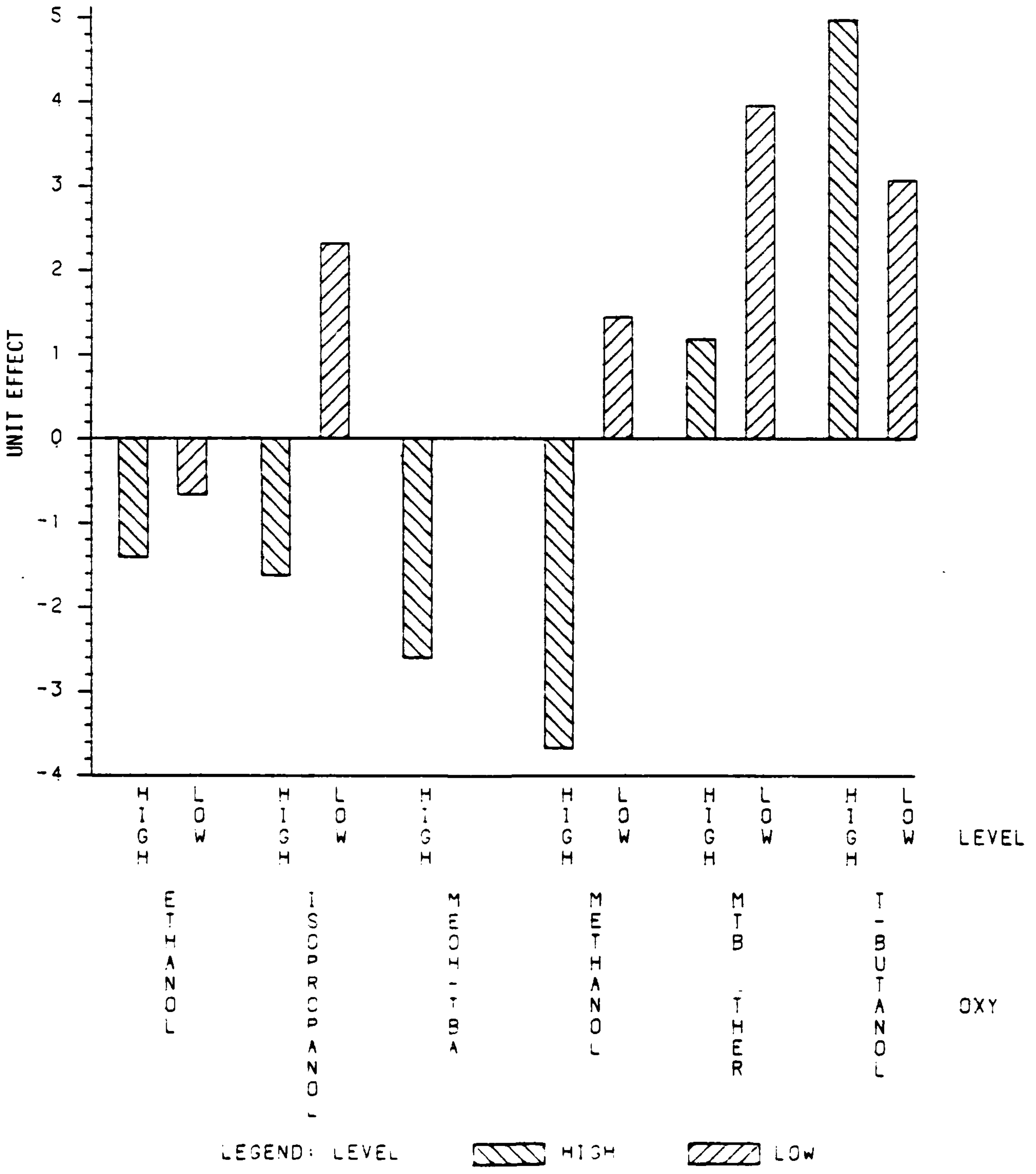


FIGURE 14

ENGINE TYPE EFFECTS FOR LOW AND HIGH CONCENTRATIONS

BASED ON MEASURED CONCENTRATIONS

GRADE=REGULAR

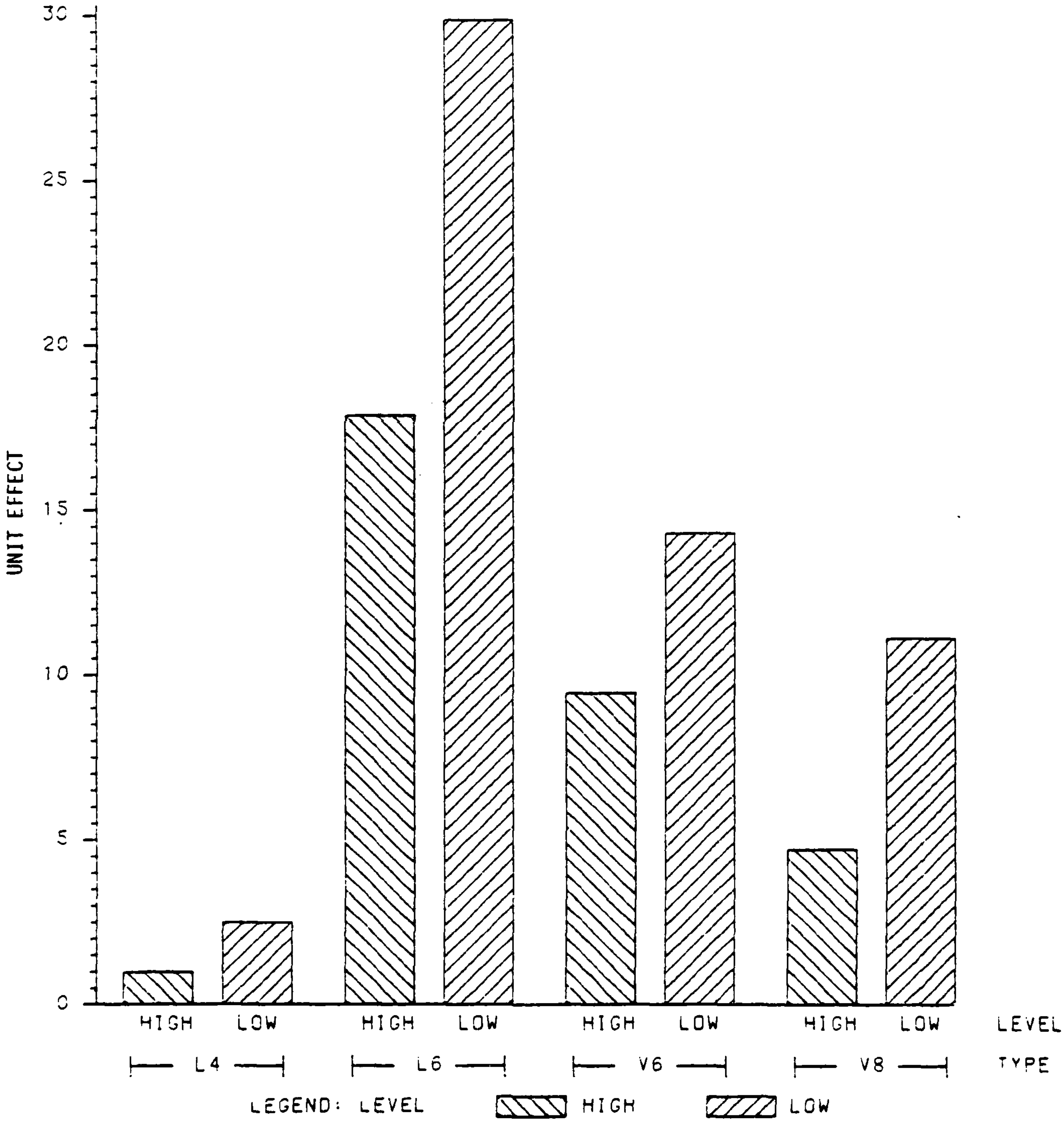


FIGURE 13

ENGINE TYPE EFFECTS FOR LOW AND HIGH CONCENTRATIONS

BASED ON MEASURED CONCENTRATIONS

GRADE=PREMIUM

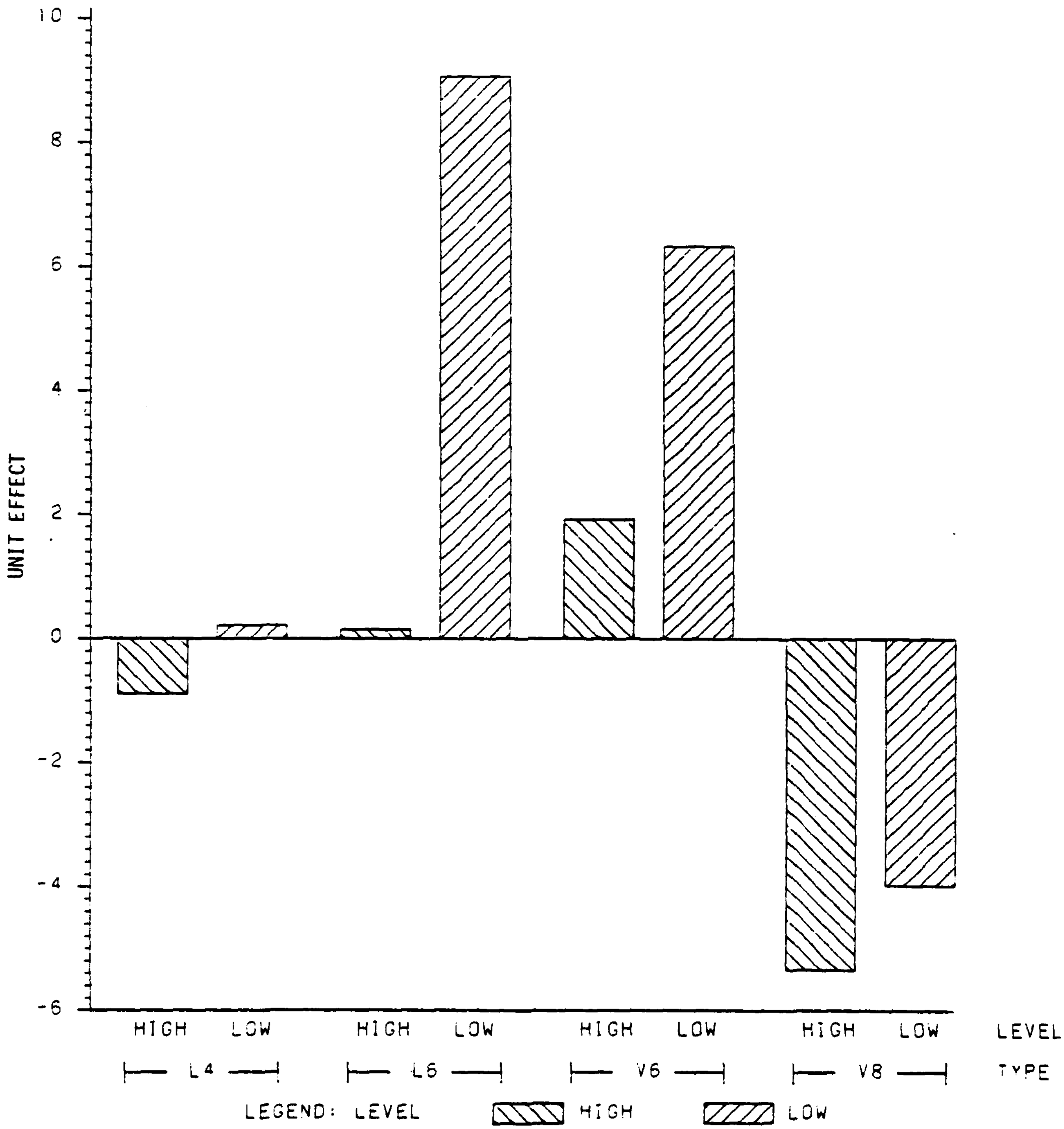


FIGURE 12
OXYGENATE EFFECTS FOR PREMIUM AND REGULAR GRADES

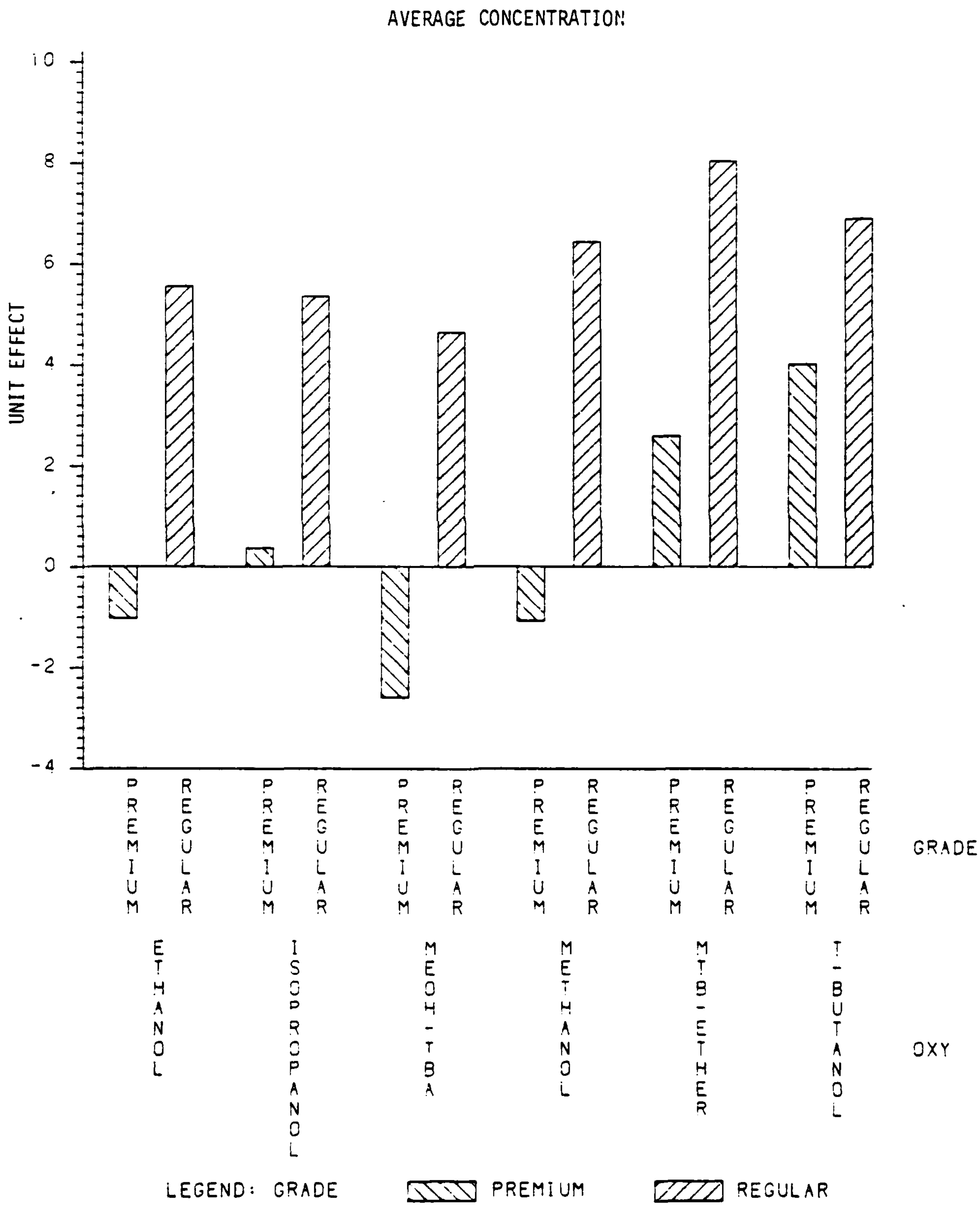


FIGURE 11

EFFECT OF CONCENTRATION ON OXYGENATE EFFECT

GRADE=REGULAR

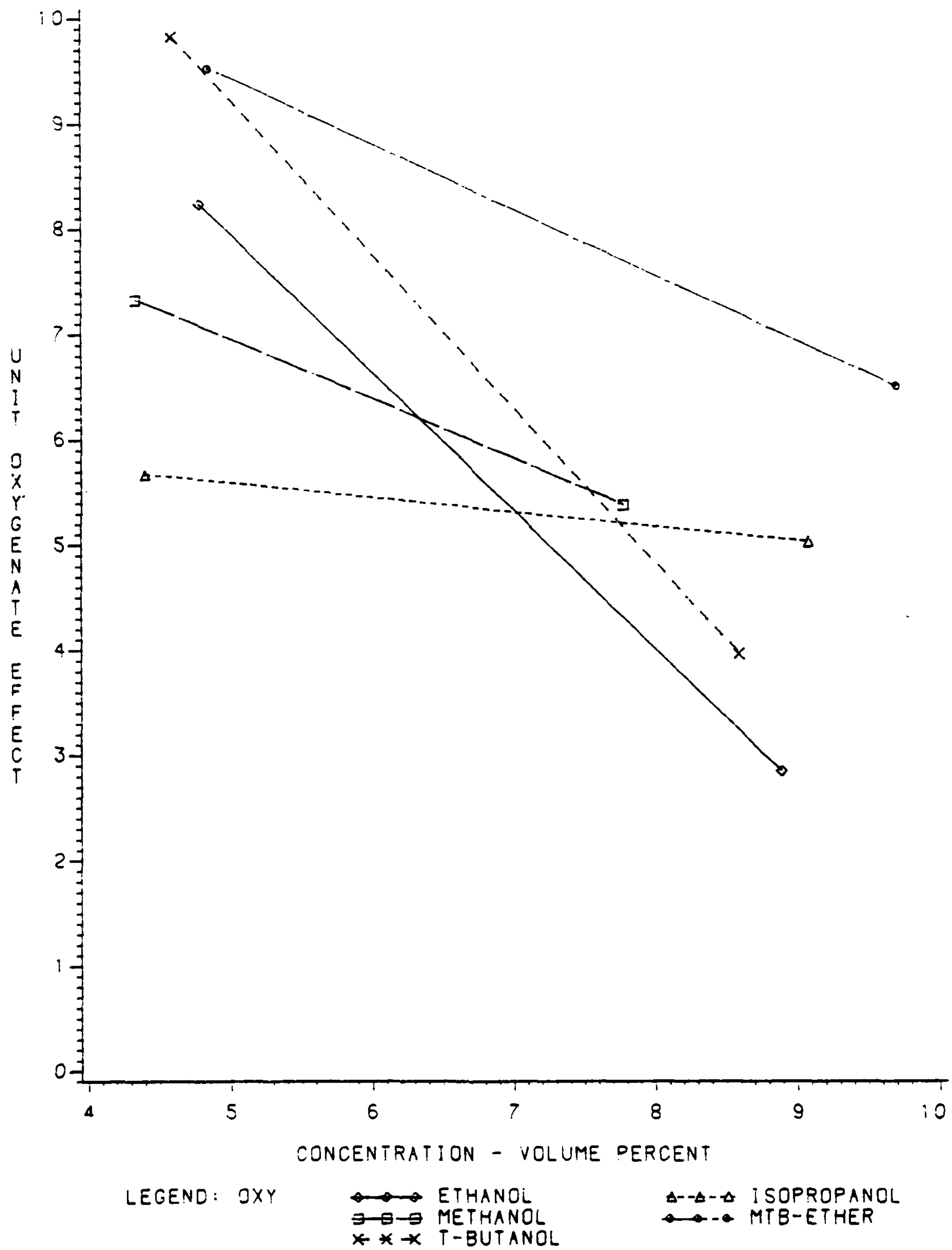


FIGURE 10

EFFECT OF CONCENTRATION ON OXYGENATE EFFECT

GRADE=PREMIUM

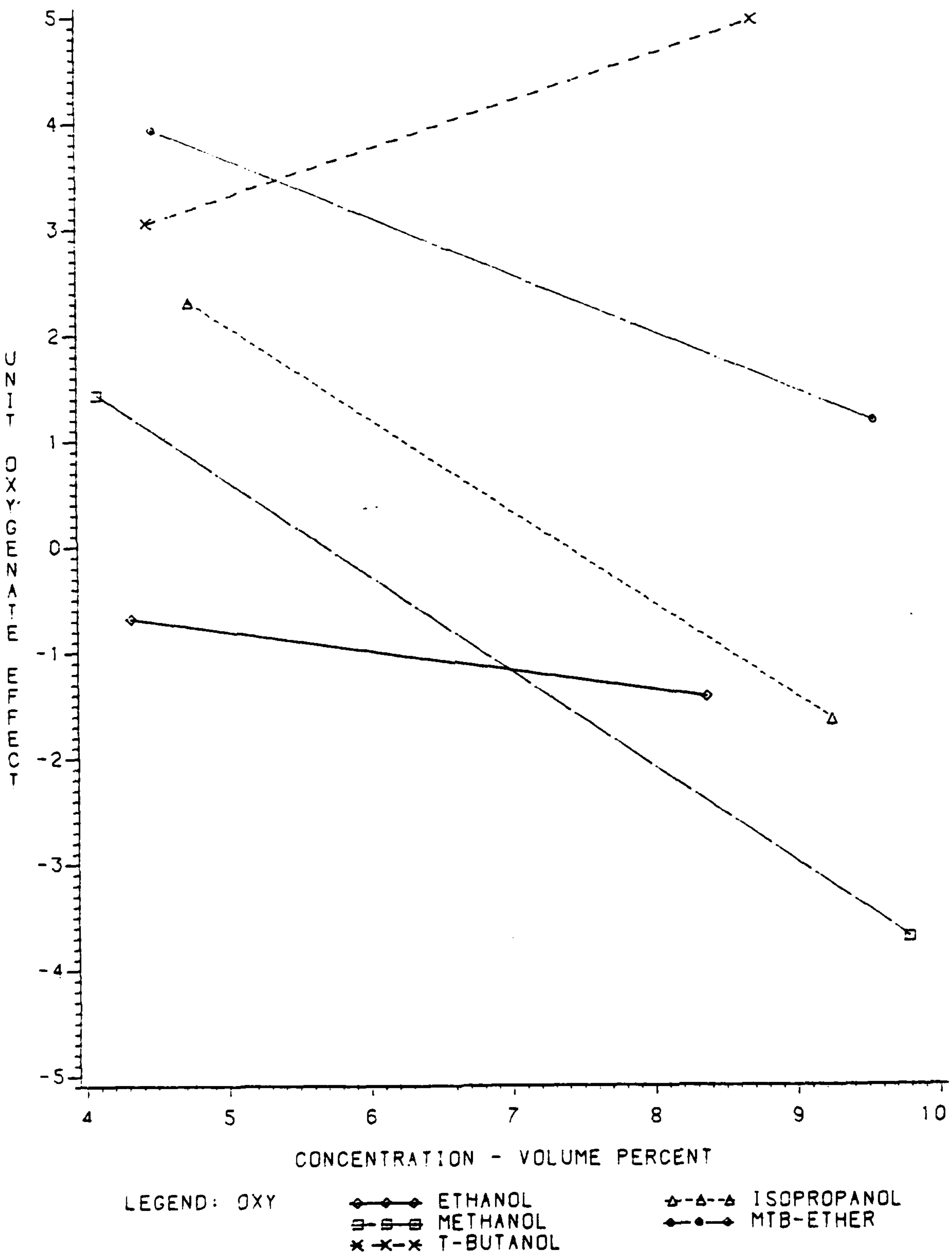
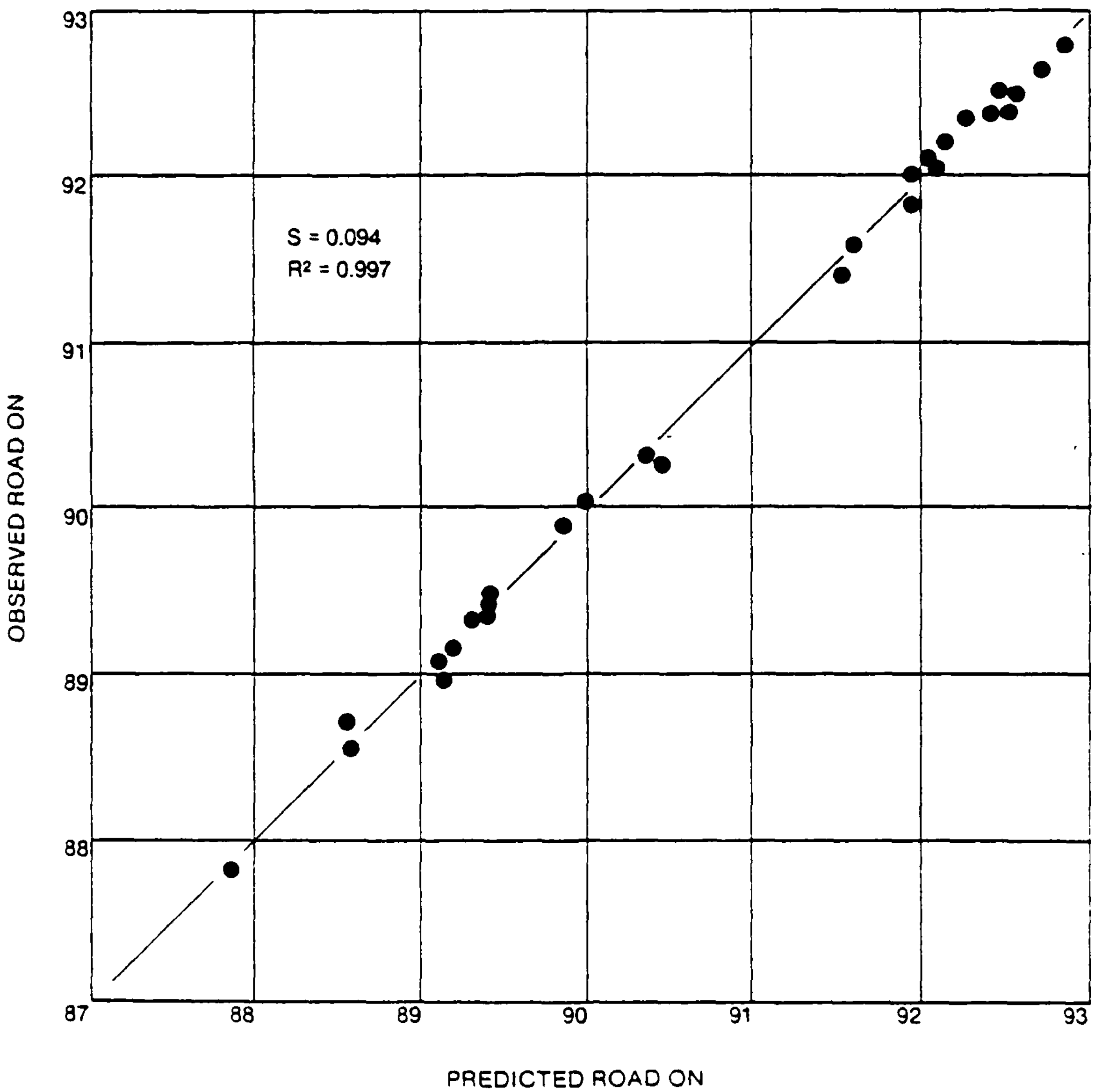


Figure 9

PREDICTION OF 38-CAR AVERAGE FULL-THROTTLE ROAD ON BY RON, MON, $(RON)^2$, TOLUENE, TERTIARY BUTANOL, METHYL T-BUTYL ETHER EQUATION
All Cars Tested



ROAD ON = -120.013 + 3.597 RON + 0.326 MON - 0.0175 $(RON)^2$
+ 0.013 TOLUENE + 0.032 T-BUTANOL + 0.031 METHYL T-BUTYL ETHER

Other cars will be selected to provide a population of cars representative of the cars to be sold during the year 1982.

Engines of cars used for road rating the fuels in this program should not be altered from their factory configuration except as necessary for instrumentation required for the modified Uniontown technique. The cars should have at least 6000 miles and maximum octane requirements (CRC E-15 technique) of at least 86 RON with 1981 or 1982 FBRU fuels. Cars used for part-throttle ratings should have part-throttle octane requirements of at least 86 RON FBRU. In addition, spark timing should not exceed the following limits when rating any of the test fuels -- 10 degrees retarded to 25 degrees advanced relative to manufacturer's recommended basic timing.

IV. Test Fuels

The following oxygenates will be tested at both 5% and 10% by volume -- methanol, ethanol, isopropanol, tertiary butyl alcohol, and methyl tertiary butyl ether. In addition, methanol and tertiary butyl alcohol will be tested in combination at 5% each. As shown in Table I and Figure 1, the oxygenates will be tested in two different base gasolines; one representing regular unleaded gasolines with an (R + M)/2 of 85-86, and the other representing premium unleaded gasolines with an (R + M)/2 of 89.5-90.5. Each base gasoline will also be tested with and without 15% toluene. This will allow calculation of blending octane numbers for the oxygenates as well as toluene. Two special gasoline blends will be included to improve the evaluation of the effects of RON and MON. There will be six octane levels of the gasolines not containing oxygenates.

Test fuels specifications are shown in Table II. In addition to the usual specification for octanes, volatility, and miscellaneous items, the supplier will have to meet some special requirements. Maximum water contents are specified for the oxygenates, and the final blends will have to be clean and free of water. Each participant will check his samples for cleanliness and will run laboratory octane and volatility tests in addition to Road octane tests. R100 tests will be run to evaluate the front-end octane quality of the test fuels.

V. Test Procedure

All fuels are to be rated in duplicate in each car by the Modified Uniontown (CRC designation F-28-70) technique. Ratings are to be obtained at full throttle (maximum or wide open) and at the most critical part-throttle condition occurring with manifold vacuum of 4 in. Hg or greater above the full-throttle vacuum. However, part-throttle tests should not be conducted if ratings cannot be determined on all test fuels without exceeding the spark advance limits. Part-throttle ratings must be determined from part-throttle primary reference fuel curves. The fuels should be rated in a random order. At least three accelerations should be made for each rating. The maximum speed investigated for modified Uniontown rating should not exceed 60 mph.

It is recommended that portable electronic spark timing control systems be used in rating the fuels. These devices are more accurate and easier to use than other systems. More important, they are easy to install on each car; and, therefore, cars used in this type of program would be out of service for only a short time. This type of spark control can be obtained from:

Electronic Systems Design
Attention: Mr. Harry E. Rueckel
317 W. University Drive
Arlington Heights, Illinois 60004
Telephone: (312) 398-0550

VI. Data Reporting

Data should be reported to CRC prior to December 1, 1982, using data forms to be provided. To aid in analysis, each participant is requested to report the manufacturer's recommended ignition timing. Also, the basic timing relative to top dead center must be reported for each modified Uniontown fuel rating. Other important details to be reported are transmission gear for full-throttle ratings, manifold vacuum for part-throttle ratings, and complete car information as indicated on the data forms.

In all cases, each participant is requested to report data for all items included on the data report forms. To assure legible copies, each participant is requested to use a soft pencil or black ink when completing the data forms in longhand.

VII. Data Analysis

Analyses will be conducted on both full-throttle and part-throttle data. Multiple linear regressions will be used to determine the effects RON, MON, the oxygenates, and toluene. Subsets of the cars will be used to determine the effects of transmission type and engine type. An overall analysis will be made using all cars after sales-weighting each car.

Analysis of variance (ANOVA) techniques will be used to evaluate individual contributions of cars, engines, transmissions, fuels, various interactions, and test error to the variability of the Road octane ratings.

TABLE I

TEST FUEL DESIGN

Fuel No.	Base Gasoline	Oxygenate	Concentration, Vol %
1	A[1]	None	-
2	A[2]	None	-
3	A	Methanol	5
4	A	Methanol	10
5	A	Ethanol	5
6	A	Ethanol	10
7	A	Isopropanol	5
8	A	Isopropanol	10
9	A	Tertiary Butanol	5
10	A	Tertiary Butanol	10
11	A	MTB Ether	5
12	A	MTB Ether	10
13	A	Methanol/TBA	5/5
14	B[3]	None	-
15	B[4]	None	-
16	B	Methanol	5
17	B	Methanol	10
18	B	Ethanol	5
19	B	Ethanol	10
20	B	Isopropanol	5
21	B	Isopropanol	10
22	B	Tertiary Butanol	5
23	B	Tertiary Butanol	10
24	B	MTB Ether	5
25	B	MTB Ether	10
26	B	Methanol/TBA	5/5
27	C[5]	None	-
28	D[6]	None	-

[1]Unleaded gasoline with (R + M)/2 = 85-86 ON and RON-MON = 6.5-7.5 ON.

[2]Base Gasoline A plus 15% toluene.

[3]Unleaded gasoline with (R + M)/2 = 89.5-90.5 ON and RON-MON = 10-11 ON.

[4]Base Gasoline B plus 15% toluene.

[5]Unleaded gasoline with (R + M)/2 = 85-86 ON and RON-MON = 9.5-10.5 ON.

[6]Unleaded gasoline with (R + M)/2 = 89.5-90.5 ON and RON-MON = 7-8 ON.

TABLE II

TEST FUEL SPECIFICATIONS

Octanes

Meet the octanes specified in Table I for Fuels 1, 14, 27 , and 28 .

Oxygenates and Toluene

Meet the specified contents within $\pm 0.5\%$ by volume. Methanol must be anhydrous. Ethanol must be at least 198-proof CDA-19 or CDA-20. Isopropyl alcohol, tertiary butyl alcohol, and methyl tertiary butyl ether must not contain more than 1% water.

Water Tolerance and Cleanliness

Final blends must be clean and bright, and they must not form water haze or droplets when chilled to 32°F. These inspections should be made on samples taken from 5-gallon cans prepared for shipping.

Volatility - All Fuels

Reid Vapor Pressure	- 7-11 Lb*
ASTM D 86 Distillation	
IBP	- 90°F Minimum
10% Evaporated	- 110-150°F
30% Evaporated	- 140-195°F
50% Evaporated	- 180-250°F
70% Evaporated	- 220-300°F
90% Evaporated	- 285-370°F
EP	- 450°F Maximum

* Fuels 27 & 28 - 8 Lb maximum RVP.

Hydrocarbon Composition

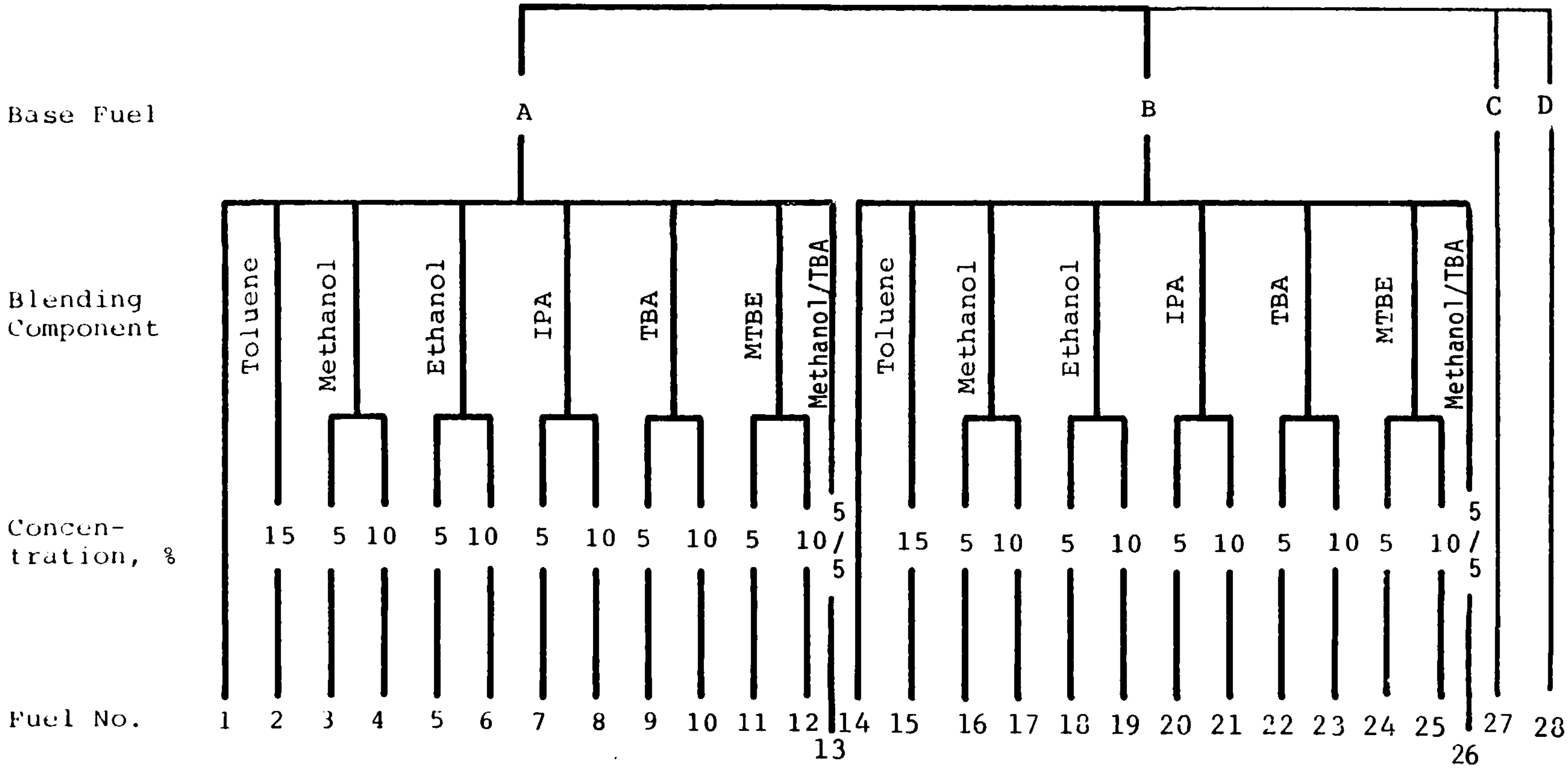
Fuels 1 and 14 must be typical of unleaded regular and premium gasolines produced in the U.S. **Fuels 1, 14 , 27 , and 28 must be blended with normal refinery components.**

Other

Total Aromatics Content	
Fuel 1	- 20-30%
Fuel 14	- 30-40%
Total Olefins Content	- 5-10%
Benzene Content	- 1% Maximum
Lead Content	- 0.03 g/Gal. Maximum
Sulfur Content	- 0.05% Maximum
Manganese	- None to be Added
Antioxidant	- 5 PTB (100% Active)
Blending Components	- Normal Refinery Components

FIGURE 1

TEST FUEL DESIGN



APPENDIX C

MODIFIED UNIONTOWN TECHNIQUE

(CRC DESIGNATION F-28-75)

INDEX OF APPENDIX C

MODIFIED UNIONTOWN TECHNIQUE

(CRC Designation F-28-75)

MODIFIED UNIONTOWN TECHNIQUE

(CRC Designation F-28-75)

This research technique has been developed for research purposes only and is not to be construed as a specification or standard, since the Coordinating Research Council, Inc. does not promulgate specifications or standards.

Prepared by the

Road Rating Techniques Study Panel

of the

CRC Light-Duty Octane Technology and Test Procedures Group

October 1975

Coordinating Research Council, Inc
219 Perimeter Center Parkway, Suite 400
Atlanta, Georgia 30346
(404) 396-3400

MODIFIED UNIONTOWN TECHNIQUE

(CRC Designation F-28-75)

A. SCOPE

The Modified Uniontown Test Technique is designed to determine a single road octane rating of a gasoline under level road accelerating conditions. The ratings are generally made at maximum throttle, but may be made at part throttle if desired or more critical. It is under these relatively severe conditions that the motoring public would probably encounter knock and thus be able to compare or evaluate fuel octane quality.

The Modified Uniontown Technique employs the vehicle's standard spark advance mechanism. The basic spark setting is varied until trace knock is obtained during acceleration for the primary reference fuel series and the gasoline(s) being rated. Trace knock is the lowest level of knock intensity that can be heard repeatedly.

The Modified Uniontown rating of a gasoline is the octane number of the RPF blend which would be expected to produce trace knock at the same basic spark advance as the test gasoline.

B. VEHICLE PREPARATION FOR TEST

The mechanical checks given below should be made as indicated. All adjustments should be made to conform with manufacturers' specifications unless otherwise specified in this section.

1. **Procurement Checks:** The checks listed below should be made upon initial receipt of vehicle for test. The vehicle should have accumulated sufficient mileage to provide adequate break-in and achieve deposit accumulation.

   (a) Compression pressures should be checked according to manufacturers' recommended procedures.

   (b) Check timing mark vs. TDC on cylinder number one piston, using a dial gage or equivalent.

   (c) Carburetors should be in good operating condition. If the vehicle is to be used for fuel rating for an extended period of time, it is recommended that carburetor mixture checks be made periodically to assure that the carburetor remains in the as-received condition.

   (d) Check the tappet clearance against manufacturers' specifications and adjust to limits.

B. <u>VEHICLE PREPARATION FOR TEST</u> - **(Continued)**

(e) Install new set of spark plugs of recommended heat range (preferably after the deposit stabilization accelerations described in E2b). For continued high-speed operation, colder plugs may be desirable.

(f) Check distributor automatic spark advance mechanism for conformance to manufacturers' recommended specifications.

(g) Check fuel pump as per manufacturers' recommended procedures. Replace fuel filter element.

(h) Observe choke plate and make certain it is in wide-open position with the engine fully warmed up. Wire open automatic choke if necessary.

(i) Check throttle opening linkage for true wide-open throttle position, freedom from sticking, etc.

(j) Check heat valve to determine if it is free and operating normally. Allow it to function as in normal driving operation.

(k) Check crankcase breather or emission control system to insure satisfactory operation. Check air cleaner element and replace if necessary.

(l) Check the exhaust emission control system for proper operation.

(m) Check the fuel system evaporative control system, and also deactivate the fuel recirculating system, if so equipped, to obviate the possibility of flooding the fuel system.

(n) Check the operating temperature of the coolant thermostat to ascertain if it is operating correctly.

(o) Check the automatic transmission's shift characteristics for conformance with manufacturer's specifications.

(p) Check all belts for tightness and condition.

2. **Daily Checks:** The daily checks should include the items listed as (h), (i) and (j) in Paragraph 1 above, and also items listed below.

(a) Check tire pressure.

(b) Check oil level.

B. VEHICLE PREPARATION FOR TEST - (Continued)

(c) Check coolant level and note type and freezing point of coolant used.

(d) Operate the vehicle to test general performance characteristics, misfiring, surging, excessive noise, etc. A check of vehicle acceleration time under standard rating conditions at manufacturers' recommended spark timing would provide a good indication of overall vehicle performance.

(e) Check brakes for safe operating and reserve pedal.

(f) Make a visual check of the engine compartment just before start of test and periodically during testing to observe general mechanical condition of the engine. Look for water, oil and gasoline leaks, or any other sign of malfunctioning.

3. **Weekly or 1,000 Mile Checks:** Weekly or 1,000 mile checks should include items (a), (i), (j), and (k) in paragraph 1 above, and also items listed below.

(a) Check auxiliary fuel systems for leaks, particularly if valving is used that might permit contamination of test or reference fuels.

(b) Check spark plugs for misfiring and gap to manufacturers' recommended procedures.

C. INSTRUMENTATION

1. **Spark Advance Measurement:** A method of accurately measuring basic spark timing should be provided. This can be done either mechanically or electronically. The equipment should be:

(a) Convenient to read from the passenger compartment during normal vehicle operation, unless remotely indicated or recorded.

(b) Capable of indicating spark timing within $\pm$ 1/2 crank-angle degree.

(c) Unaffected by the vibrations, accelerations, or shock normal to full-throttle vehicle acceleration.

C. INSTRUMENTATION - (Continued)

2. **Spark Advance Control:** A mechanism should be provided to control spark advance from the passenger compartment. This control should be positive, with a minimum of hunting or backlash, and should not be affected by engine movement due to torque reaction.

3. **Engine Speed Measurement:** A method of measuring engine revolutions per minute should be provided which is:

   (a) Capable of instantaneous reading and/or recording throughout the engine speed range.

   (b) Convenient for reading from the passenger compartment during vehicle operation.

   (c) Capable of indicating within an accuracy of $\pm$ 50 rpm and with a repeatability of $\pm$ 1% of the speed being read.

   (d) Unaffectedd by the vibrations, accelerations, or shock normal to full-throttle vehicle accelerations.

4. **Manifold Vacuum Measurement:** A vacuum gage should be connected to the intake manifold and located where it can be seen by the driver. This is important for automatic transmission test cars in order that the car can be driven repeatedly at a low engine speed and at as low a manifold vacuum as possible without automatic downshifting to a lower gear.

5. **Temperature Measurement:** While temperature measurements are not directly necessary for fuel rating, they are important for checking the general operation of the engine and for controlling the operating conditions of the car when it is used on successive occasions. It is, therefore, suggested that thermocouples be installed in the following locations and the suitable instrumentation be provided to measure or record the following temperatures:

   (a) Carburetor inlet air
   (b) Engine coolant (block exit)
   (c) Engine oil (sump or gallery)
   (d) Automatic transmission oil
   (e) Intake mixture (after stove area)

C. INSTRUMENTATION - (Continued)

6. **Weather Measurements:** It is suggested that the following ambient weather conditions be measured and recorded hourly during fuel rating tests:

   (a) Temperature
   (b) Humidity
   (c) Barometric Pressure

7. **Auxiliary Fuel System:** An auxiliary fuel system should be provided to facilitate convenient switching from one fuel to another. The auxiliary fuel line should be connected to the inlet side of the fuel pump, should be of minimum length, and should be routed in such a way as to avoid trapping fuel vapor. Installation should give consideration to safety as well as convenience of fuel handling. To minimize mixing of test fuels during fuel changeover, it is recommended that fuel settling bowls or large filters be blocked off and/or replaced by small filter assembly with the bowl mounted in an inverted position.

   If an electric fuel pump is used, the fuel pressure at the carburetor should be checked to conform with the manufacturer's recommendation.

   For cars used extensively for fuel ratings, carburetor bowl drain lines connected to a pump and waste can have been found to improve the speed and completeness of fuel system draining when changing from one fuel to another.

D. REFERENCE FUELS

Primary reference fuel blends should be prepared in two octane number increments over the range required to bracket the fuels being rated.

E. TEST PROCEDURE

1. **Engine Warmup**

   To stabilize engine temperatures, a minimum of fifteen miles of operation under road load conditions at speeds of 50 to 60 mph in top gear is required.

E. TEST PROCEDURE - (Continued)

2. **Combustion Chamber Deposits Stabilization**

(a) Cars should have a minimum of 2,000 deposit miles prior to use for road octane rating. The last 500 miles should be accumulated under medium to high speed conditions to insure stabilization of combustion chamber deposits.

(b) Just prior to conducting each series of road octane rating tests, the following deposit stabilization run should be made:

(1) With the vehicle fully warmed up, set the spark timing to produce approximately light knock on tank fuel or other fuel which knocks near the manufacturer's recommended spark setting. (Knock should cover the expected range of testing.)

(2) At the above spark setting, make several accelerations over the speed range in which road ratings are desired. The accelerations should be conducted primarily at wide-open throttle employing part throttle only as required to limit maximum knock to light intensity.

3. **Fuel Changeover**

(a) Catalytic Device Cars

Caution: Because of the installation of catalytic devices on these cars, permanent damage may result if the engine runs over lean or stalls. Therefore, changeover from one fuel to another must be accomplished without running the carburetor dry.

To eliminate contamination of the new fuel with residual amounts of the previous fuel, the car will be operated under the following conditions after charging with the new fuel: operate car for 2 miles at a maximum speed of 55 mph during which time four part-throttle accelerations at approximately 4" Hg manifold vacuum are made.

(b) Non-catalytic device cars or catalytic device cars for which the manufacturer has provided written approval to run the carburetor dry with assurance the procedure will not damage the catalytic device.

(1) With one- and two-barrel carburetors, the carburetor shall be run dry at 55 mph, road load, in highest gear.

TABLE E-II
(Continued)

FULL-THROTTLE ROAD ON REGRESSION EQUATIONS

All-Car Averages; 38 Cars; Road ON Mean = 90.792

			Coefficients*															
Eqn.	Std. Dev.	R^2	Constant* b_0	RON b_1	MON b_2	(R+M)/2 b_3	$(RON)^2$ b_4	$(MON)^2$ b_5	ΔR-100 b_6	ΔM-100 b_7	Toluene b_8	Oxygenates b_9	Methanol b_{10}	Ethanol b_{11}	Iso-propanol b_{12}	Tertiary Butanol b_{13}	Methyl t-Butyl Ether b_{14}	Methanol/ t-Butanol b_{15}
8	0.142	0.993	-102.359 (0.010)	3.158 (0.0006)	0.376 (0.0001)		-0.0153 (0.001)		0.014 (0.309)									
9	0.143	0.993	-105.661 (0.009)	3.230 (0.0005)	0.377 (0.0001)		-0.0157 (0.001)			0.024 (0.417)								
10	0.145	0.993	-99.236 (0.018)	3.087 (0.001)	0.376 (0.0001)		-0.0149 (0.003)		0.025 (0.498)	-0.025 (0.751)								
11	0.165	0.990	-168.000 (0.120)	0.313 (0.0001)	5.100 (0.050)			-0.0282 (0.069)	0.026 (0.144)									
12	0.170	0.990	-145.352 (0.185)	0.310 (0.0001)	4.565 (0.084)			-0.0250 (0.113)		0.033 (0.377)								
13	0.165	0.991	-164.311 (0.128)	0.317 (0.0001)	5.009 (0.054)			-0.0277 (0.074)	0.064 (0.125)	-0.089 (0.304)								
14	0.175	0.989	29.882 (0.0001)	0.288 (0.0001)	0.402 (0.0001)						0.006 (0.466)							
15	0.177	0.988	29.958 (0.0001)	0.289 (0.0001)	0.400 (0.0001)							0.001 (0.938)						
16	0.172	0.989	30.309 (0.0001)	0.299 (0.0001)	0.385 (0.0001)								-0.016 (0.272)					

* See last page.

TABLE E-II

FULL-THROTTLE ROAD ON REGRESSION EQUATIONS

All-Car Averages; 38 Cars; Road ON Mean = 90.792

			Coefficients*															
Eqn.	Std. Dev.	R^2	Constant* b_0	RON b_1	MON b_2	(R+M)/2 b_3	$(RON)^2$ b_4	$(MON)^2$ b_5	Δ R-100 b_6	Δ M-100 b_7	Toluene b_8	Oxygenates b_9	Methanol b_{10}	Ethanol b_{11}	Iso-propanol b_{12}	Tertiary Butanol b_{13}	Methyl t-Butyl Ether b_{14}	Methanol/ t-Butanol b_{15}
1a	0.303	0.963	45.106 (0.0001)	0.488 (0.0001)														
1b	0.380	0.942	14.465 (0.0006)		0.904 (0.0001)													
1	0.173	0.988	29.964 (0.0001)	0.289 (0.0001)	0.400 (0.0001)													
2	0.176	0.988	32.481 (0.0001)			0.655 (0.0001)												
3	0.142	0.993	-103.107 (0.001)	3.165 (0.000)	0.378 (0.0001)		-0.0153 (0.001)											
4	0.170	0.989	-114.050 (0.266)	0.309 (0.0001)	3.815 (0.122)			-0.0205 (0.164)										
5	0.174	0.989	30.239 (0.0001)	0.287 (0.0001)	0.399 (0.0001)				0.015 (0.400)									
6	0.176	0.988	30.160 (0.0001)	0.287 (0.0001)	0.400 (0.0001)					0.013 (0.717)								
7	0.174	0.989	30.053 (0.0001)	0.292 (0.0001)	0.395 (0.0001)				0.056 (0.201)	-0.094 (0.300)								

* See last page.

TABLE E-I

ROAD OCTANE EQUATIONS

Car No.	Standard Deviation	R^2	Constant*	Coefficients* RON	MON
1	0.376	0.960	22.517	0.362	0.401
2	0.251	0.980	27.629	0.375	0.337
3	0.361	0.942	37.989	0.288	0.318
4	0.298	0.935	44.618	0.177	0.334
5	0.655	0.905	15.950	0.366	0.504
6	0.780	0.796	31.643	0.244	0.449
7	0.372	0.922	38.332	0.172	0.431
8	0.548	0.930	13.649	0.334	0.549
9	0.495	0.969	9.903	0.815	0.082
10	0.727	0.838	14.383	0.085	0.806
11	0.521	0.860	38.383	0.211	0.365
12	0.449	0.885	31.304	0.055	0.623
13	0.508	0.769	48.443	0.057	0.435
14	0.754	0.828	37.837	0.440	0.142
15	0.319	0.975	26.140	0.473	0.273
16	0.699	0.583	48.965	-0.043	0.552
17	0.466	0.532	74.984	0.120	0.067
18	0.343	0.945	31.770	0.178	0.500
19	0.571	0.824	36.654	0.119	0.503
20	0.314	0.903	47.551	0.098	0.379
21	0.648	0.892	15.704	0.292	0.547
22	0.382	0.918	36.534	0.155	0.461
23	0.889	0.774	31.773	0.358	0.279
24	1.444	0.477	45.684	0.371	0.055
25	0.490	0.955	15.256	0.509	0.345
26	0.994	0.564	63.086	0.406	-0.130
27	0.592	0.656	69.168	0.296	-0.089
28	0.576	0.817	44.039	0.248	0.237
29	0.691	0.955	-17.755	0.743	0.465
30	0.529	0.936	19.287	0.416	0.406
31	0.475	0.944	26.160	0.447	0.306
32	0.662	0.888	15.199	0.261	0.608
33	0.357	0.951	22.620	0.141	0.659
34	0.451	0.966	-5.317	0.586	0.527
35	0.770	0.728	28.013	0.008	0.714
36	0.664	0.725	42.015	0.072	0.497
37	0.373	0.940	26.376	0.166	0.556
38	0.756	0.941	-19.689	0.576	0.670
All Car Average			30.023**	0.289	0.399

* Constant and coefficients not significant at the 95% confidence level (PR >0.05) are underlined.

** Calculated from Road ON, RON, and MON means and averaged RON and MON coefficients. Average constant from equations is 29.916.

APPENDIX E

ROAD OCTANE EQUATIONS

------------------------ GRADE=REGULAR OXY=MTBE2 ------------------------

OBS	AVGCONC	CONC	DIFF
98	0.0970	0.075	0.025
99	0.0970	0.105	-0.005
100	0.0970	0.117	-0.017
101	0.0970	0.096	0.004
102	0.0970	0.092	0.008

------------------------ GRADE=REGULAR OXY=TBA1 ------------------------

OBS	AVGCONC	CONC	DIFF
103	0.0460	0.042	0.008
104	0.0460	0.048	0.002
105	0.0460	0.051	-0.001
106	0.0460	0.043	0.007
107	0.0460	0.046	0.004

------------------------ GRADE=REGULAR OXY=TBA2 ------------------------

OBS	AVGCONC	CONC	DIFF
108	0.0860	0.091	0.009
109	0.0860	0.084	0.016
110	0.0860	0.100	0.000
111	0.0860	0.068	0.032
112	0.0860	0.087	0.013

------------------------ GRADE=REGULAR OXY=TBA3 ------------------------

OBS	AVGCONC	CONC	DIFF
113	0.0444	0.045	0.005
114	0.0444	0.040	0.010
115	0.0444	0.047	0.003
116	0.0444	0.045	0.005
117	0.0444	0.045	0.005

<u>NOTE</u>: DIFF = Nominal minus Measured Concentration.

GRADE=REGULAR OXY=IPA2

OBS	AVGCONC	CONC	DIFF
74	0.0908	0.074	0.026
75	0.0908	0.086	0.014
76	0.0908	0.094	0.006
77	0.0908	0.105	-0.005
78	0.0908	0.095	0.005

GRADE=REGULAR OXY=MEOH1

OBS	AVGCONC	CONC	DIFF
79	0.0434	0.043	0.007
80	0.0434	0.046	0.004
81	0.0434	0.044	0.006
82	0.0434	0.047	0.003
83	0.0434	0.037	0.013

GRADE=REGULAR OXY=MEOH2

OBS	AVGCONC	CONC	DIFF
84	0.0778	0.083	0.017
85	0.0778	0.072	0.028
86	0.0778	0.061	0.039
87	0.0778	0.106	-0.006
88	0.0778	0.067	0.033

GRADE=REGULAR OXY=MEOH3

OBS	AVGCONC	CONC	DIFF
89	0.0440	0.044	0.006
90	0.0440	0.042	0.008
91	0.0440	0.046	0.004
92	0.0440	0.044	0.006

GRADE=REGULAR OXY=MTBE1

OBS	AVGCONC	CONC	DIFF
93	0.0486	0.033	0.017
94	0.0486	0.052	-0.002
95	0.0486	0.063	-0.013
96	0.0486	0.051	-0.001
97	0.0486	0.044	0.006

NOTE: DIFF = Nominal minus Measured Concentration.

GRADE=PREMIUM OXY=TBA2

OBS	AVGCONC	CONC	DIFF
50	0.0872	0.091	0.009
51	0.0872	0.089	0.011
52	0.0872	0.100	0.000
53	0.0872	0.069	0.031
54	0.0872	0.087	0.013

GRADE=PREMIUM OXY=TBA3

OBS	AVGCONC	CONC	DIFF
55	0.0492	0.046	0.004
56	0.0492	0.049	0.001
57	0.0492	0.050	0.000
58	0.0492	0.048	0.002
59	0.0492	0.053	-0.003

GRADE=REGULAR OXY=ETOH1

OBS	AVGCONC	CONC	DIFF
60	0.0480	0.044	0.006
61	0.0480	0.048	0.002
62	0.0480	0.047	0.003
63	0.0480	0.054	-0.004
64	0.0480	0.047	0.003

GRADE=REGULAR OXY=ETOH2

OBS	AVGCONC	CONC	DIFF
65	0.0890	0.087	0.013
66	0.0890	0.087	0.013
67	0.0890	0.088	0.012
68	0.0890	0.093	0.007
69	0.0890	0.090	0.010

GRADE=REGULAR OXY=IPA1

OBS	AVGCONC	CONC	DIFF
70	0.0440	0.035	0.015
71	0.0440	0.048	0.002
72	0.0440	0.045	0.005
73	0.0440	0.048	0.002

NOTE: DIFF = Niminal minus Measured Concentration.

GRADE=PREMIUM OXY=MEOH2

OBS	AVGCONC	CONC	DIFF
25	0.0980	0.091	0.009
26	0.0980	0.102	-0.002
27	0.0980	0.092	0.008
28	0.0980	0.106	-0.006
29	0.0980	0.099	0.001

GRADE=PREMIUM OXY=MEOH3

OBS	AVGCONC	CONC	DIFF
30	0.0478	0.048	0.002
31	0.0478	0.041	0.009
32	0.0478	0.053	-0.003
33	0.0478	0.044	0.006
34	0.0478	0.053	-0.003

GRADE=PREMIUM OXY=MTBE1

OBS	AVGCONC	CONC	DIFF
35	0.0450	0.032	0.018
36	0.0450	0.046	0.004
37	0.0450	0.053	-0.003
38	0.0450	0.050	0.000
39	0.0450	0.044	0.006

GRADE=PREMIUM OXY=MTBE2

OBS	AVGCONC	CONC	DIFF
40	0.0956	0.071	0.029
41	0.0956	0.105	-0.005
42	0.0956	0.106	-0.006
43	0.0956	0.093	0.007
44	0.0956	0.103	-0.003

GRADE=PREMIUM OXY=TBA1

OBS	AVGCONC	CONC	DIFF
45	0.0446	0.047	0.003
46	0.0446	0.042	0.008
47	0.0446	0.046	0.004
48	0.0446	0.044	0.006
49	0.0446	0.044	0.006

<u>NOTE</u>: DIFF = Nominal minus Measured Concentration.

GRADE=PREMIUM OXY=ETOH1

OBS	AVGCONC	CONC	DIFF
1	0.0434	0.041	0.009
2	0.0434	0.045	0.005
3	0.0434	0.042	0.008
4	0.0434	0.044	0.006
5	0.0434	0.045	0.005

GRADE=PREMIUM OXY=ETOH2

OBS	AVGCONC	CONC	DIFF
6	0.0838	0.084	0.016
7	0.0838	0.094	0.006
8	0.0838	0.079	0.021
9	0.0838	0.073	0.027
10	0.0838	0.089	0.011

GRADE=PREMIUM OXY=IPA1

OBS	AVGCONC	CONC	DIFF
11	0.0474	0.034	0.016
12	0.0474	0.050	0.000
13	0.0474	0.043	0.007
14	0.0474	0.062	-0.012
15	0.0474	0.048	0.002

GRADE=PREMIUM OXY=IPA2

OBS	AVGCONC	CONC	DIFF
16	0.0925	0.074	0.026
17	0.0925	0.096	0.004
18	0.0925	0.100	0.000
19	0.0925	0.100	0.000

GRADE=PREMIUM OXY=MEOH1

OBS	AVGCONC	CONC	DIFF
20	0.0410	0.039	0.011
21	0.0410	0.041	0.009
22	0.0410	0.043	0.007
23	0.0410	0.040	0.010
24	0.0410	0.042	0.008

NOTE: DIFF = Nominal minus Measured Concentration.

APPENDIX D

MEASURED OXYGENATE CONCENTRATIONS

F. REPORT AND INTERPRETATION OF DATA*

1. Calculate average basic spark advance for each fuel. Where rechecks have been run, use all valid spark advance observations.

2. Establish basic spark advance vs. octane number curve for reference fuels.

3. Obtain the octane number rating of each test gasoline by determining the octane number corresponding to the average basic spark advance value. The octane number is reported with the speed of maximum knock.

4. The reproducibility** of the Modified Uniontown Road Octane Number Test has been found to be about one octane number. Therefore, it is recommended that when the result of a single determination is to be reported it should be rounded off to the nearest 0.5 number. However, when multiple ratings are obtained, these individual ratings should not be rounded off, but the average may or may not be, depending on the individual laboratory's testing errors, and the ultimate utilization of the rating number.

---

* All calculations described herein may be accomplished either manually or by E.D.P. (electronic data process).

** Reproducibility is a quantitative expression of the random error associated with single determinations at different laboratories of a property of an identical material utilizing the same method. It represents the maximum difference between such measurements which would be expected to be exceeded in a given percentage of cases.

The reproducibility figures quoted above are calculated for one standard deviation which is normally exceeded in about 30% of the cases. Reproducibility is currently defined as the square root of the total testing variance minus the fuel variance.

(It must be noted that this reproducibility figure does not correspond to that of ASTM, which is normally exceeded in only one case out of 20.)

E. TEST PROCEDURE - (Continued)

(c) Subsequent accelerations should be spaced at relatively constant time increments in order that repeatability of testing conditions is assured. Excessive braking between accelerations should not be utilized as temperature equilibria may not be reached before each successive acceleration is commenced. Experience with a particular vehicle and/or testing condition may dictate otherwise, but a time period of approximately 20 seconds between successive accelerations with several seconds at constant speed before the start of each acceleration is considered satisfactory to yield reproducible results.

(d) The first one or more accelerations is exploratory, to enable the operator to become acquainted with the knocking characteristics of the fuel. At least two accelerations are made for recording of data. Basic spark advances required for trace knock intensity are recorded with the corresponding speed range of knocking.

(e) With adequate instrumentation and adherence to procedural details, basic spark advances for trace knock accelerations generally will not differ more than one crankshaft degree. In such instances, two trace knock accelerations shall suffice and the average of the spark settings for the two accelerations shall be reported for the fuel.

If the spark advances for the first two trace knock accelerations will differ by more than one degree, one or more additional accelerations shall be made as required to establish a good average spark setting.

(f) It is recommended that at least four different reference fuels be run to establish a reference fuel framework before running the test gasolines. Additional reference fuels should be interspersed with the test gasolines to complete the reference fuel framework in two octane number increments. Several reference fuels should be rechecked at intervals.

E. TEST PROCEDURE - (Continued)

(c) Care should be taken not to operate at greater than light knock intensity because of the effect on combustion chamber temperatures and knock intensity during the remainder of the acceleration.

(d) Excessively advanced or retarded ignition timings may lead to abnormal fuel ratings. Where possible, road rating determinations should be made within the range of 15 degrees advance to 10 degrees retard from the manufacturers' standard spark advance (recommended basic ignition timing plus centrifugal spark advance) at any speed.

(e) The speed range investigated will normally extend to 3,000 rpm, but where conditions necessitate, should be extended beyond.

5. **Details of Observations**

(a) The vehicles should be accelerated from as low a speed as practicable to as high a speed as desired. For manual transmission cars, the acceleration should be made in highest gear from the lowest speed giving reasonably smooth operation; the minimum engine speed will normally be about 700 rpm.

In the case of automatic transmission cars, the critical rating condition is dependent upon the transmission control system and may vary considerably among car makes. Operating characteristics of each vehicle should be explored to determine the drive ratio and throttle position which will allow operation at or near wide-open throttle over the widest range of engine speed with the gear selector in Drive position. It may be expedient to decrease intake manifold vacuum during the acceleration in accordance with a schedule predetermined for the particular test car.

(b) Adjust basic spark timing to produce knock of trace intensity over as narrow a speed range as possible during the acceleration. Trace knock is defined as the lowest level of knock that is readily and constantly discernible to the ear. It is NOT the threshold between knock and no knock. Generally, the spark setting should not be changed during an acceleration except when encountering heavy knock. All comparative tests with different fuels must be made at the same trace knock intensity over the same speed range, recognizing that all fuels may not knock in the same portion of the speed range.

E. TEST PROCEDURE - (Continued)

(2) With four-barrel carburetors, the primary float chamber shall be run dry at 55 mph, road load in highest gear. The secondary float chamber shall be run dry by going to wide-open throttle for short periods of time, being careful to avoid excessively high engine speeds. This must be accomplished in passing gear on those vehicles in which the secondary throttle plates are mechanically actuated by depressing the throttle beyond the detent position.

Caution: In cars equipped with automatic transmissions, care should be taken to maintain the car speed sufficiently high to keep the engine turning over. This is especially important to cars equipped with power brakes since a serious safety hazard may be encountered with a dead engine.

(c) Charge the fuel system with a new test fuel and repeat the operations described in paragraphs (a) or (b).

(d) After fuel changeover, make one preliminary acceleration before beginning Vehicle Rating Procedure and operate one-half mile at 50 to 60 mph, road load, to obtain stabilized conditions.

4. **Operating Conditions**

(a) The vehicles should be tested at or as near maximum throttle as possible over the widest practicable speed range.

In the case of manual transmissions, this is wide-open throttle in top gear.

In the case of automatic transmissions, it is dependent upon the transmission control system and may vary considerably among car makes. Operating characteristics of each vehicle should be explored to determine the drive ratio which will allow operation at or near wide-open throttle over the widest range of engine speed.

(b) Fuel ratings should be run on a smooth, level, straight road in either direction as long as audibility of knock is not affected by the wind. Tests shall not be conducted during periods of rain or rapidly changing weather conditions. Fuel ratings may also be run on a chassis dynamometer with proven good road correlation.

TABLE E-II
(Continued)

FULL-THROTTLE ROAD ON REGRESSION EQUATIONS

All-Car Averages; 38 Cars; Road ON Mean = 90.792

			Coefficients*															
Eqn.	Std. Dev.	R^2	Constant* b_0	RON b_1	MON b_2	(R+M)/2 b_3	$(RON)^2$ b_4	$(MON)^2$ b_5	ΔR-100 b_6	ΔM-100 b_7	Toluene b_8	Oxygenates b_9	Methanol b_{10}	Ethanol b_{11}	Iso-propanol b_{12}	Tertiary Butanol b_{13}	Methyl t-Butyl Ether b_{14}	Methanol/ t-Butanol b_{15}
17	0.175	0.989	29.943 (0.0001)	0.292 (0.0001)	0.397 (0.0001)									-0.009 (0.498)				
18	0.177	0.988	29.883 (0.0001)	0.289 (0.0001)	0.401 (0.0001)										-0.004 (0.759)			
19	0.170	0.989	30.126 (0.0001)	0.297 (0.0001)	0.389 (0.0001)											0.018 (0.188)		
20	0.164	0.990	30.852 (0.0001)	0.300 (0.0001)	0.377 (0.0001)												0.023 (0.064)	
21	0.173	0.989	29.504 (0.0001)	0.285 (0.0001)	0.410 (0.0001)													-0.016 (0.279)
22	0.140	0.993	-107.378 (0.007)	3.265 (0.0004)	0.379 (0.0001)		-0.0159 (0.001)				0.009 (0.207)							
23	0.145	0.993	-103.398 (0.011)	3.169 (0.0007)	0.379 (0.0001)		-0.0153 (0.002)					0.001 (0.859)						
24	0.141	0.993	-99.644 (0.012)	3.110 (0.0007)	0.366 (0.0001)		-0.0150 (0.002)						-0.013 (0.277)					
25	0.141	0.993	-107.116 (0.008)	3.250 (0.0004)	0.372 (0.0001)		-0.0157 (0.001)							-0.013 (0.250)				

* See last page.

TABLE E-II
(Continued)

FULL-THROTTLE ROAD ON REGRESSION EQUATIONS

All-Car Averages; 38 Cars; Road ON Mean = 90.792

			Coefficients*															
Eqn.	Std. Dev.	R^2	Constant* b_0	RON b_1	MON b_2	(R+M)/2 b_3	$(RON)^2$ b_4	$(MON)^2$ b_5	Δ R-100 b_6	Δ M-100 b_7	Toluene b_8	Oxygenates b_9	Methanol b_{10}	Ethanol b_{11}	Iso-propanol b_{12}	Tertiary Butanol b_{13}	Methyl t-Butyl Ether b_{14}	Methanol/ t-Butanol b_{15}
26	0.144	0.993	-104.363 (0.010)	3.187 (0.0006)	0.378 (0.0001)		-0.0154 (0.002)								-0.006 (0.586)			
27	0.132	0.994	-129.595 (0.004)	3.555 (0.0001)	0.362 (0.0001)		-0.0163 (0.0004)									0.023 (0.039)		
28	0.129	0.994	-102.682 (0.005)	3.181 (0.0002)	0.354 (0.0001)		-0.0153 (0.0006)										0.023 (0.020)	
29	0.139	0.993	-103.714 (0.008)	3.172 (0.0005)	0.387 (0.0001)		-0.0154 (0.001)											-0.016 (0.173)
30	0.171	0.990	-121.448 (0.242)	0.309 (0.0001)	3.987 (0.110)			-0.0215 (0.148)			0.007 (0.388)							
31	0.172	0.989	-126.183 (0.252)	0.310 (0.0001)	4.093 (0.121)			-0.0221 (0.160)				-0.004 (0.722)						
32	0.164	0.990	-158.369 (0.129)	0.330 (0.0001)	4.849 (0.053)			-0.0268 (0.074)					-0.023 (0.114)					
33	0.169	0.990	-138.796 (0.190)	0.317 (0.0001)	4.395 (0.084)			-0.0240 (0.114)						-0.014 (0.298)				
34	0.172	0.989	-119.999 (0.254)	0.310 (0.0001)	3.952 (0.118)			-0.0213 (0.158)							-0.006 (0.632)			

* See last page.

TABLE E-II
(Continued)

FULL-THROTTLE ROAD ON REGRESSION EQUATIONS

All-Car Averages; 38 Cars; Road ON Mean = 90.792

			Coefficients*															
Eqn.	Std. Dev.	R^2	Constant* b_0	RON b_1	MON b_2	(R+M)/2 b_3	$(RON)^2$ b_4	$(MON)^2$ b_5	Δ R-100 b_6	Δ M-100 b_7	Toluene b_8	Oxygenates b_9	Methanol b_{10}	Ethanol b_{11}	Iso-propanol b_{12}	Tertiary Butanol b_{13}	Methyl t-Butyl Ether b_{14}	Methanol/ t-Butanol b_{15}
35	0.167	0.990	-114.140 (0.258)	0.317 (0.0001)	3.807 (0.116)			-0.0205 (0.156)								0.018 (0.179)		
36	0.159	0.991	-126.433 (0.192)	0.322 (0.0001)	4.099 (0.078)			-0.0223 (0.108)									0.024 (0.045)	
37	0.170	0.990	-102.431 (0.324)	0.304 (0.0001)	3.531 (0.155)			-0.0187 (0.206)										-0.013 (0.354)
38	0.108	0.996	-112.637 (0.0001)	3.422 (0.0001)	0.329 (0.0001)		-0.0165 (0.0001)									0.029 (0.003)	0.028 (0.002)	
39	0.094	0.997	-120.013 (0.0001)	3.597 (0.0001)	0.326 (0.0001)		-0.0175 (0.0001)				0.013 (0.010)					0.032 (0.0004)	0.031 (0.0002)	

* Number within parentheses represents the probability that the coefficient or constant is not significant. Constant and coefficients not significant at the 95% confidence level (>0.05) are underlined.

TABLE E-III

PART-THROTTLE ROAD ON REGRESSION EQUATIONS

Part-Throttle PRF (Except Lab 7); 9-Car Averages; Road ON Mean = 86.858

*Coefficients**

Eqn.	Std. Dev.	R^2	Constant* b_0	RON b_1	MON b_2	(R+M)/2 b_3	$(RON)^2$ b_4	$(MON)^2$ b_5	Δ R-100 b_6	Δ M-100 b_7	Toluene b_8	Oxygenates b_9	Methanol b_{10}	Ethanol b_{11}	Iso-propanol b_{12}	Tertiary Butanol b_{13}	Methyl t-Butyl Ether b_{14}	Methanol/ t-Butanol b_{15}
1a	0.434	0.893	49.973 (0.0001)	0.394 (0.0001)														
1b	0.386	0.915	23.872 (0.0001)		0.746 (0.0001)													
1	0.336	0.938	32.939 (0.0001)	0.171 (0.006)	0.449 (0.0002)													
2	0.349	0.930	39.408 (0.0001)			0.533 (0.0001)												
14	0.340	0.939	32.945 (0.0001)	0.169 (0.006)	0.451 (0.0003)						0.012 (0.487)							
15	0.343	0.938	32.860 (0.0001)	0.171 (0.006)	0.450 (0.0004)							-0.001 (0.941)						
16	0.332	0.942	33.791 (0.0001)	0.192 (0.003)	0.416 (0.0007)								-0.034 (0.220)					
17	0.343	0.938	33.017 (0.0001)	0.172 (0.006)	0.447 (0.0004)									-0.003 (0.897)				
18	0.334	0.941	33.166 (0.0001)	0.171 (0.005)	0.446 (0.0003)										0.027 (0.267)			

* See last page.

TABLE E-III
(Continued)

PART-THROTTLE ROAD ON REGRESSION EQUATIONS

Part-Throttle PRF (Except Lab 7); 9-Car Averages; Road ON Mean = 86.858

Eqn.	Std. Dev.	R^2	Constant* b_0	RON b_1	MON b_2	(R+M)/2 b_3	$(RON)^2$ b_4	$(MON)^2$ b_5	Δ R-100 b_6	Δ M-100 b_7	Toluene b_8	Oxygenates b_9	Methanol b_{10}	Ethanol b_{11}	Iso-propanol b_{12}	Tertiary Butanol b_{13}	Methyl t-Butyl Ether b_{14}	Methanol/ t-Butanol b_{15}
19	0.338	0.940	33.248 (0.0001)	0.181 (0.004)	0.434 (0.0005)											0.023 (0.406)		
20	0.343	0.938	33.170 (0.0001)	0.173 (0.007)	0.444 (0.0005)												0.004 (0.866)	
21	0.353	0.941	32.178 (0.0001)	0.164 (0.008)	0.466 (0.0002)													-0.0029 (0.298)

* Number within parentheses represents the probability that the coefficient or constant is not significant. Constant and coefficients not significant at the 95% confidence level (>0.05) are underlined.

A P P E N D I X   F

ROAD OCTANE EQUATIONS FOR HYDROCARBON FUELS

TABLE F-I

ROAD OCTANE EQUATION SUMMARY

Car	Constant	RON Coefficient	MON Coefficient	Standard Deviations
1	18.26	0.4597	0.3423	0.56
2	26.66	0.3679	0.3546	0.32
3	32.91	0.5130	0.1261	0.40
4	44.84	0.2790	0.2157	0.36
5	15.16	0.4501	0.4142	0.99
6	16.62	0.6586	0.1685	1.00
7	33.85	0.2724	0.3734	0.44
8	9.42	0.3936	0.5302	0.84
9	13.41	0.8230	0.0292	0.80
10	6.75	0.2237	0.7496	0.66
11	37.91	0.2566	0.3215	0.99
12	27.19	0.0773	0.6447	0.85
13	48.41	0.0440	0.4506	0.28
14	50.33	0.1612	0.3066	0.64
15	28.07	0.5157	0.2009	0.29
16	53.95	-0.1336	0.5951	0.63
17	79.74	0.0378	0.0993	0.41
18	27.48	0.3135	0.3997	0.76
19	50.47	0.1331	0.3453	0.73
20	52.83	-0.0052	0.4289	0.42
21	14.92	0.5382	0.2837	0.66
22	37.38	0.1536	0.4518	0.46
23	27.30	0.2429	0.4620	1.05
24	43.35	0.2912	0.1969	1.49
25	14.56	0.6846	0.1546	0.49
26	63.11	0.6676	-0.4190	1.01
27	67.96	0.4386	-0.2312	0.62
28	42.73	0.2682	0.2318	0.80
29	-8.90	0.6027	0.5111	0.93
30	14.22	0.6540	0.1997	0.38
31	25.28	0.5945	0.1585	0.24
32	26.30	0.4201	0.2957	0.47
33	20.14	0.0660	0.7701	0.31
34	-6.14	0.6168	0.5038	0.55
35	23.20	-0.0509	0.8333	0.86
36	40.33	0.1723	0.4057	0.59
37	24.58	0.1448	0.6023	0.43
38	-20.26	0.8241	0.4236	0.80
Average	29.04	0.3466	0.3403	

APPENDIX G

OXYGENATE EFFECTS: FULL-THROTTLE RESULTS

1982 CRC ROAD ON PROGRAM
TABULATION OF EFFECTS ON ROAD OCTANE PERFORMANCE
BASED ON MEASURED CONCENTRATIONS

------------------------ OXY=ETHANOL GRADE=PREMIUM ------------------------

OBS	LEVEL	TYPE	CAR	INTERCEP	EFFECT
1	HIGH	V6	1	-0.0730	-3.838
2	HIGH	V6	2	0.1617	0.480
3	HIGH	L6	3	0.1852	-7.413
4	HIGH	V8	4	-0.1074	-2.802
5	HIGH	L6	5	-0.7215	8.582
6	HIGH	V6	6	-0.2754	-11.717
7	HIGH	V8	7	-0.1442	-4.078
8	HIGH	V6	8	0.1316	0.988
9	HIGH	V6	9	-0.7093	10.267
10	HIGH	V8	10	-0.1899	-16.513
11	HIGH	L4	11	0.0098	-7.102
12	HIGH	L6	12	0.1593	4.744
13	HIGH	L4	13	0.1046	1.722
14	HIGH	L4	14	0.4289	-1.077
15	HIGH	L4	15	0.0604	2.264
16	HIGH	L4	16	-0.3281	8.704
17	HIGH	L4	17	0.0247	-4.221
18	HIGH	L4	18	-0.1183	-1.473
19	HIGH	L4	19	0.0717	-0.150
20	HIGH	V6	20	0.2080	7.652
21	HIGH	L4	21	0.4327	-17.990
22	HIGH	L4	22	-0.1404	0.227
23	HIGH	L4	23	0.6302	0.412
24	HIGH	L4	24	0.7704	-0.532
25	HIGH	L4	25	0.0435	-3.360
26	HIGH	V6	26	-1.3838	-2.463
27	HIGH	L4	27	-0.8189	6.657
28	HIGH	V6	28	-1.1888	0.839
29	HIGH	L4	29	-0.8603	23.043
30	HIGH	L4	30	-0.2309	-7.812
31	HIGH	L4	31	-0.2894	-12.656
32	HIGH	L4	32	-0.3860	14.512
33	HIGH	L4	33	0.2749	-1.934
34	HIGH	V6	35	0.1601	-9.420
35	HIGH	L4	36	-0.0002	-12.256
36	HIGH	L4	37	0.3540	-3.873
37	HIGH	L4	38	1.0321	-20.002
38	LOW	V6	1	-0.0730	3.751
39	LOW	V6	2	0.1617	3.[illegible]
40	LOW	L6	3	0.1852	-8.184
41	LOW	V8	4	-0.1074	0.537
42	LOW	L6	5	-0.7215	37.44[illegible]
43	LOW	V6	6	-0.2754	-47.[illegible]
44	LOW	V8	7	-0.1442	6.[illegible]
45	LOW	V6	8	0.1316	0.396

1982 CRC ROAD ON PROGRAM
TABULATION OF EFFECTS ON ROAD OCTANE PERFORMANCE
BASED ON MEASURED CONCENTRATIONS

------------------------- OXY=ETHANOL GRADE=PREMIUM -------------------------

OBS	LEVEL	TYPE	CAR	INTERCEP	EFFECT
46	LOW	V6	9	-0.7093	29.024
47	LOW	V8	10	-0.1879	-40.680
48	LOW	L4	11	0.0098	-1.351
49	LOW	L6	12	0.1593	-2.345
50	LOW	L4	13	0.1046	-0.521
51	LOW	L4	14	0.4289	-2.661
52	LOW	L4	15	0.0604	7.810
53	LOW	L4	16	-0.3281	24.357
54	LOW	L4	17	0.0247	15.699
55	LOW	L4	18	-0.1163	-8.925
56	LOW	L4	19	0.0717	14.637
57	LOW	V6	20	0.2080	4.759
58	LOW	L4	21	0.4327	-24.153
59	LOW	L4	22	-0.1404	8.849
60	LOW	L4	23	0.6302	-23.944
61	LOW	L4	24	0.7704	-61.438
62	LOW	L4	25	0.0435	-4.567
63	LOW	V6	26	-1.3835	2.899
64	LOW	L4	27	-0.8180	-7.105
65	LOW	V6	28	-1.1486	2.053
66	LOW	L4	29	-0.8603	42.428
67	LOW	L4	30	-0.2399	4.837
68	LOW	L4	31	-0.2894	-13.452
69	LOW	L4	32	-0.3860	22.970
70	LOW	L4	33	0.2749	0.579
71	LOW	L4	34	-0.2907	3.353
72	LOW	V6	35	0.1601	1.900
73	LOW	L4	36	-0.0002	25.162
74	LOW	L4	37	0.3540	-11.748
75	LOW	L4	38	1.0321	-31.617

1982 CRC ROAD ON PROGRAM
TABULATION OF EFFECTS ON ROAD OCTANE PERFORMANCE
BASED ON MEASURED CONCENTRATIONS

------------------------ OXY=ETHANOL GRADE=REGULAR ------------------------

OBS	LEVEL	TYPE	CAR	INTERCEP	EFFECT
76	HIGH	V6	1	-0.4476	9.084
77	HIGH	V6	2	-0.1386	2.096
78	HIGH	L6	3	-0.3742	8.741
79	HIGH	V8	4	-0.4479	7.522
80	HIGH	L6	5	-1.2304	24.154
81	HIGH	V6	6	-1.2735	26.947
82	HIGH	V8	7	-0.4243	11.430
83	HIGH	V6	8	-0.8846	19.716
84	HIGH	V6	9	-0.4018	6.938
85	HIGH	V8	10	-0.2924	-14.140
86	HIGH	L4	11	0.4579	-15.216
87	HIGH	L6	12	-0.8098	21.415
88	HIGH	L4	13	-0.0087	-9.998
89	HIGH	L4	14	-0.4600	-14.080
90	HIGH	L4	15	-0.0415	-1.022
91	HIGH	L4	16	-0.5689	-15.302
92	HIGH	L4	17	-0.2043	1.968
93	HIGH	L4	18	-0.3889	5.407
94	HIGH	L4	19	-0.1316	-10.795
95	HIGH	V6	20	-0.0043	0.249
96	HIGH	L4	21	-0.0535	-1.279
97	HIGH	L4	22	0.0345	3.056
98	HIGH	L4	23	-0.8640	11.360
99	HIGH	L4	24	-0.2485	15.780
100	HIGH	L4	25	-0.1749	13.630
101	HIGH	V6	26	-0.6016	-9.073
102	HIGH	L4	27	0.1799	-4.992
103	HIGH	V6	28	-0.0091	-1.875
104	HIGH	L4	29	0.2133	-1.497
105	HIGH	L4	30	-0.3691	13.517
106	HIGH	L4	31	-0.1991	-0.547
107	HIGH	L4	32	0.2749	-4.151
108	HIGH	L4	33	-0.1686	4.409
109	HIGH	L4	34	-0.4460	7.519
110	HIGH	V6	35	-0.4644	10.382
111	HIGH	L4	36	0.8024	-9.964
112	HIGH	L4	37	-0.0485	-3.393
113	HIGH	L4	38	0.0091	-0.737
114	LOW	V6	1	-0.4476	19.828
115	LOW	V6	2	-0.1386	8.460
116	LOW	L6	3	-0.3742	27.185
117	LOW	V8	4	-0.4479	19.791
118	LOW	L6	5	-1.2304	[illegible]
119	LOW	V6	6	-1.2735	[illegible]
120	LOW	V8	7	-0.4243	9.600

1982 CRC ROAD ON PROGRAM
TABULATION OF EFFECTS ON ROAD OCTANE PERFORMANCE
BASED ON MEASURED CONCENTRATIONS

------------------------ OXY=ETHANOL GRADE=REGULAR ------------------------

OBS	LEVEL	TYPE	CAR	INTERCEP	EFFECT
121	LOW	V6	8	-0.88460	32.627
122	LOW	V6	9	-0.40176	18.475
123	LOW	V8	10	-0.29236	11.222
124	LOW	L4	11	0.45786	3.463
125	LOW	L6	12	-0.80978	20.341
126	LOW	L4	13	-0.00868	-19.612
127	LOW	L4	14	-0.45996	-23.655
128	LOW	L4	15	-0.04150	9.309
129	LOW	L4	16	-0.56894	-11.521
130	LOW	L4	17	-0.20426	-6.663
131	LOW	L4	18	-0.38886	17.250
132	LOW	L4	19	-0.13158	5.868
133	LOW	V6	20	-0.00434	2.185
134	LOW	L4	21	-0.05354	6.031
135	LOW	L4	22	0.03452	-6.375
136	LOW	L4	23	-0.36396	[illegible].342
137	LOW	L4	24	-0.24850	-8.434
138	LOW	L4	25	-0.17492	24.083
139	LOW	V6	26	-0.60164	13.385
140	LOW	L4	27	0.17992	-[illegible].25[illegible]
141	LOW	V6	28	-0.00012	-4.063
142	LOW	L4	29	0.21334	10.[illegible]
143	LOW	L4	30	-0.36996	24.5[illegible]1
144	LOW	L4	31	-0.12210	-4.461
145	LOW	L4	32	0.27400	-8.1[illegible]
146	LOW	L4	33	-0.168[illegible]	14.385
147	LOW	L4	34	-0.44596	4.474
148	LOW	V6	35	-[illegible].4645[illegible]	[illegible]
149	LOW	L4	36	0.80242	-7.1[illegible]3
150	LOW	L4	37	-0.01846	-3.[illegible]41
151	LOW	L4	38	0.00998	4.6[illegible]

1982 CRC ROAD OCTANE PROGRAM
TABULATION OF EFFECTS ON ROAD OCTANE PERFORMANCE
BASED ON MEASURED CONCENTRATIONS

OXY=ISOPROPANOL GRADE=PREMIUM

OBS	LEVEL	TYPE	CAR	INTERCEP	EFFECT
152	HIGH	V6	1	-0.0730	-4.607
153	HIGH	V6	2	0.1617	1.102
154	HIGH	L6	3	0.1852	-6.796
155	HIGH	V8	4	-0.1074	0.597
156	HIGH	L6	5	-0.7215	9.273
157	HIGH	V6	6	-0.2754	-21.462
158	HIGH	V8	7	-0.1442	-7.245
159	HIGH	V6	8	0.1316	-2.301
160	HIGH	V6	9	-0.7093	7.423
161	HIGH	V8	10	-0.1890	-14.803
162	HIGH	L4	11	0.0098	-8.375
163	HIGH	L6	12	0.1593	-2.551
164	HIGH	L4	13	0.1046	-2.520
165	HIGH	L4	14	0.4289	-7.097
166	HIGH	L4	15	0.0604	-7.287
167	HIGH	L4	16	-0.3281	7.205
168	HIGH	L4	17	0.0247	1.097
169	HIGH	L4	18	-0.1183	0.130
170	HIGH	L4	19	0.0717	9.796
171	HIGH	V6	20	0.2080	5.905
172	HIGH	L4	21	0.4327	-16.440
173	HIGH	L4	22	-0.1404	0.381
174	HIGH	L4	23	0.6302	-2.312
175	HIGH	L4	24	0.7704	-10.737
176	HIGH	L4	25	0.0435	-5.656
177	HIGH	V6	26	-1.3838	24.333
178	HIGH	L4	27	-0.8189	-1.653
179	HIGH	V6	28	-1.1888	17.931
180	HIGH	L4	29	-0.8603	12.112
181	HIGH	L4	30	-0.2309	-5.545
182	HIGH	L4	31	-0.2894	-10.683
183	HIGH	L4	32	-0.3560	4.464
184	HIGH	L4	33	0.2749	-1.212
185	HIGH	V6	35	0.1601	0.075
186	HIGH	L4	36	-0.2092	2.717
187	HIGH	L4	37	0.3540	-3.533
188	HIGH	L4	38	1.0321	-22.6[illegible]
189	LOW	V6	1	-0.0730	1.452
190	LOW	V6	2	0.1617	[illegible]
191	LOW	L6	3	0.1852	-11.098
192	LOW	V8	4	-0.1074	-[illegible].777
193	LOW	L6	5	-0.7215	19.[illegible]
194	LOW	V6	6	-[illegible]	-1[illegible]
195	LOW	V8	7	-[illegible].1[illegible]	2.[illegible]
196	LOW	V6	8	0.1316	-[illegible].67[illegible]

1982 CRC ROAD ON PROGRAM
TABULATION OF EFFECTS ON ROAD OCTANE PERFORMANCE
BASED ON MEASURED CONCENTRATIONS

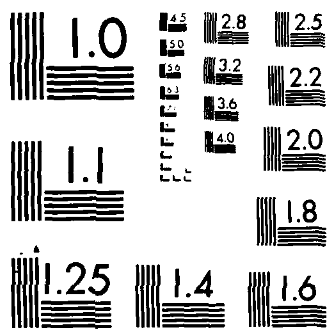
------------------- OXY=ISOPROPANOL GRADE=PREMIUM -------------------

OBS	LEVEL	TYPE	CAR	INTERCEP	EFFECT
197	LOW	V6	9	-0.7093	15.039
198	LOW	V6	10	-0.1899	-5.243
199	LOW	L4	11	0.0098	-0.366
200	LOW	L6	12	0.1593	-3.157
201	LOW	L4	13	0.1046	-2.517
202	LOW	L4	14	0.4289	-0.306
203	LOW	L4	15	0.0604	5.988
204	LOW	L4	16	-0.3281	25.187
205	LOW	L4	17	0.0247	4.484
206	LOW	L4	18	-0.1183	-2.391
207	LOW	L4	19	0.0717	19.921
208	LOW	V6	20	0.2080	8.244
209	LOW	L4	21	0.4327	-11.182
210	LOW	L4	22	-0.1404	3.597
211	LOW	L4	23	0.6302	-58.521
212	LOW	L4	24	0.7704	-15.604
213	LOW	L4	25	0.0435	8.188
214	LOW	V6	26	-1.3338	34.639
215	LOW	L4	27	-0.8149	-6.414
216	LOW	V6	28	-1.1386	10.884
217	LOW	L4	29	-0.4603	45.185
218	LOW	L4	30	-0.2309	5.193
219	LOW	L4	31	-0.2824	-7.885
220	LOW	L4	32	-0.3860	16.409
221	LOW	L4	33	0.2749	7.362
222	LOW	L4	34	-0.2907	-1.449
223	LOW	V6	35	0.1601	27.024
224	LOW	L4	36	-0.0002	15.292
225	LOW	L4	37	0.3841	-4.134
226	LOW	L4	38	0.0321	-47.171

AD-A159 127 1982 CRC FUEL RATING PROGRAM: ROAD OCTANE PERFORMANCE OF OXYGENATES IN 1982 MODEL CARS(U) COORDINATING RESEARCH COUNCIL INC ATLANTA GA JUL 85 CRC-541

2/3

UNCLASSIFIED F/G 21/4 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

1982 CRC ROAD ON PROGRAM
TABULATION OF EFFECTS ON ROAD OCTANE PERFORMANCE
BASED ON MEASURED CONCENTRATIONS

------------------------ OXY=ISOPROPANOL GRADE=REGULAR ------------------------

OBS	LEVEL	TYPE	CAR	INTERCEP	EFFECT
227	HIGH	V6	1	-0.4476	9.591
228	HIGH	V6	2	-0.1386	5.076
229	HIGH	L6	3	-0.3742	9.128
230	HIGH	V8	4	-0.4479	8.405
231	HIGH	L6	5	-1.2304	30.552
232	HIGH	V6	6	-1.2735	20.457
233	HIGH	V8	7	-0.4243	9.380
234	HIGH	V6	8	-0.8846	14.949
235	HIGH	V6	9	-0.4018	19.815
236	HIGH	V8	10	-0.2924	-2.311
237	HIGH	L4	11	0.4579	4.393
238	HIGH	L6	12	-0.8098	10.206
239	HIGH	L4	13	-0.0087	-1.770
240	HIGH	L4	14	-0.4600	-11.013
241	HIGH	L4	15	-0.0415	2.037
242	HIGH	L4	16	-0.5689	-1.288
243	HIGH	L4	17	-0.2043	12.035
244	HIGH	L4	18	-0.3889	7.870
245	HIGH	L4	19	-0.1316	-4.120
246	HIGH	V6	20	-0.0043	1.604
247	HIGH	L4	21	-0.0535	-3.750
248	HIGH	L4	22	0.0345	6.758
249	HIGH	L4	23	-0.8640	5.975
250	HIGH	L4	24	-0.2485	-15.909
251	HIGH	L4	25	-0.1749	4.891
252	HIGH	V6	26	-0.6016	9.189
253	HIGH	L4	27	0.1799	1.926
254	HIGH	V6	28	-0.0001	4.635
255	HIGH	L4	29	0.2133	-4.066
256	HIGH	L4	30	-0.3691	15.605
257	HIGH	L4	31	-0.1991	-6.985
258	HIGH	L4	32	0.2749	-0.117
259	HIGH	L4	33	-0.1686	5.941
260	HIGH	L4	34	-0.4466	5.463
261	HIGH	V6	35	-0.4644	14.021
262	HIGH	L4	36	0.8024	-2.930
263	HIGH	L4	37	-0.2455	[illegible]
264	HIGH	L4	38	0.0091	15.250
265	LOW	V6	1	-0.4475	12.76[illegible]
266	LOW	V6	2	-0.1386	8.233
267	LOW	L6	3	-0.3742	23.302
268	LOW	V8	4	-0.4479	[illegible]
269	LOW	L6	5	-1.2304	[illegible]
270	LOW	V6	6	-1.2735	[illegible]
271	LOW	V8	7	-0.4243	[illegible]

1982 CRC ROAD ON PROGRAM
TABULATION OF EFFECTS ON ROAD OCTANE PERFORMANCE
BASED ON MEASURED CONCENTRATIONS

------------------------ OXY=ISOPROPANOL GRADE=REGULAR ------------------------

OBS	LEVEL	TYPE	CAR	INTERCEP	EFFECT
272	LOW	V6	8	-0.88460	29.665
273	LOW	V6	9	-0.40176	1.899
274	LOW	V8	10	-0.29236	-13.055
275	LOW	L4	11	0.45786	-20.402
276	LOW	L6	12	-0.80978	24.710
277	LOW	L4	13	-0.00868	10.911
278	LOW	L4	14	-0.45996	-9.275
279	LOW	L4	15	-0.04150	0.697
280	LOW	L4	16	-0.56894	1.735
281	LOW	L4	17	-0.20426	9.382
282	LOW	L4	18	-0.38886	14.910
283	LOW	L4	19	-0.13158	12.410
284	LOW	V6	20	-0.00434	-18.303
285	LOW	L4	21	-0.05354	25.927
286	LOW	L4	22	0.03452	1.849
287	LOW	L4	23	-0.85396	24.054
288	LOW	L4	24	-0.24850	5.445
289	LOW	L4	25	-0.17492	29.141
290	LOW	V6	26	-0.60164	1.162
291	LOW	L4	27	0.17992	0.863
292	LOW	V6	28	-0.00012	-10.475
293	LOW	L4	29	0.21334	-2.231
294	LOW	L4	30	-0.36906	13.254
295	LOW	L4	31	-0.19910	-8.189
296	LOW	L4	32	0.27490	-10.478
297	LOW	L4	33	-0.16858	12.661
298	LOW	L4	34	-0.44596	-21.927
299	LOW	V6	35	-0.46438	16.555
300	LOW	L4	36	0.80242	-28.340
301	LOW	L4	37	-0.04846	-6.714
302	LOW	L4	38	0.00908	-7.766

1982 CRC ROAD ON PROGRAM
TABULATION OF EFFECTS ON ROAD OCTANE PERFORMANCE
BASED ON MEASURED CONCENTRATIONS

------------------------ OXY=METHANOL GRADE=PREMIUM ------------------------

OBS	LEVEL	TYPE	CAR	INTERCEP	EFFECT
303	HIGH	V6	1	-0.0730	-1.037
304	HIGH	V6	2	0.1617	0.709
305	HIGH	L6	3	0.1852	-6.929
306	HIGH	V8	4	-0.1074	-1.653
307	HIGH	L6	5	-0.7215	6.113
308	HIGH	V6	6	-0.2754	-25.786
309	HIGH	V8	7	-0.1442	-7.196
310	HIGH	V6	8	0.1316	0.476
311	HIGH	V6	9	-0.7093	4.251
312	HIGH	V8	10	-0.1899	-21.613
313	HIGH	L4	11	0.0098	-4.073
314	HIGH	L6	12	0.1593	-5.090
315	HIGH	L4	13	0.1046	0.183
316	HIGH	L4	14	0.4289	1.663
317	HIGH	L4	15	0.0604	-3.262
318	HIGH	L4	16	-0.3281	2.138
319	HIGH	L4	17	0.0247	9.935
320	HIGH	L4	18	-0.1183	-6.240
321	HIGH	L4	19	0.0717	-9.617
322	HIGH	V6	20	0.2080	4.534
323	HIGH	L4	21	0.4327	-5.413
324	HIGH	L4	22	-0.1404	-2.277
325	HIGH	L4	23	0.6302	-4.196
326	HIGH	L4	24	0.7704	-34.891
327	HIGH	L4	25	0.0435	1.099
328	HIGH	V6	26	-1.3838	10.626
329	HIGH	L4	27	-0.8180	15.252
330	HIGH	V6	28	-1.1936	4.229
331	HIGH	L4	29	-0.8603	16.014
332	HIGH	L4	30	-0.2399	-12.726
333	HIGH	L4	31	-0.2894	-15.993
334	HIGH	L4	32	-0.3660	6.861
335	HIGH	L4	33	0.2749	1.003
336	HIGH	V6	35	0.1601	10.624
337	HIGH	L4	36	-0.0002	-16.125
338	HIGH	L4	37	0.3640	-9.817
339	HIGH	L4	38	1.0321	-38.475
340	LOW	V6	1	-0.0730	-6.457
341	LOW	V6	2	0.1617	-4.092
342	LOW	L6	3	0.1852	-4.421
343	LOW	V8	4	-0.1074	3.696
344	LOW	L6	5	-0.7215	35.577
345	LOW	V6	6	-[illegible]	-[illegible]
346	LOW	[illegible]	[illegible]	-[illegible]	-[illegible]
347	LOW	V6	8	0.1316	10.582

1982 CRC ROAD ON PROGRAM
TABULATION OF EFFECTS ON ROAD OCTANE PERFORMANCE
BASED ON MEASURED CONCENTRATIONS

------------------------ OXY=METHANOL GRADE=PREMIUM ------------------------

OBS	LEVEL	TYPE	CAR	INTERCEP	EFFECT
348	LOW	V6	9	-0.7093	31.298
349	LOW	V8	10	-0.1899	-8.243
350	LOW	L4	11	0.0098	-13.902
351	LOW	L6	12	0.1593	2.913
352	LOW	L4	13	0.1046	5.198
353	LOW	L4	14	0.4289	11.488
354	LOW	L4	15	0.0604	-2.986
355	LOW	L4	16	-0.3231	0.963
356	LOW	L4	17	0.0247	19.450
357	LOW	L4	18	-0.1183	-5.823
358	LOW	L4	19	0.0717	20.512
359	LOW	V6	20	0.2080	-1.394
360	LOW	L4	21	0.4327	-29.154
361	LOW	L4	22	-0.1404	11.197
362	LOW	L4	23	0.6302	-13.928
363	LOW	L4	24	0.7704	60.826
364	LOW	L4	25	0.0435	-14.286
365	LOW	V6	26	-1.3838	4.265
366	LOW	L4	27	-0.8189	-9.718
367	LOW	V6	28	-1.1888	24.600
368	LOW	L4	29	-0.8603	46.358
369	LOW	L4	30	-0.2399	4.501
370	LOW	L4	31	-0.2894	-14.916
371	LOW	L4	32	-0.3860	1.561
372	LOW	L4	33	0.2749	4.200
373	LOW	L4	34	-0.2907	-6.474
374	LOW	V6	35	0.1601	-8.424
375	LOW	L4	36	-0.0002	-15.148
376	LOW	L4	37	0.3540	-14.728
377	LOW	L4	38	1.0321	-51.59[illegible]

1982 CRC ROAD ON PROGRAM
TABULATION OF EFFECTS ON ROAD OCTANE PERFORMANCE
BASED ON MEASURED CONCENTRATIONS

---------------------- OXY=METHANOL GRADE=REGULAR ----------------------

OBS	LEVEL	TYPE	CAR	INTERCEP	EFFECT
378	HIGH	V6	1	-0.4476	16.003
379	HIGH	V6	2	-0.1386	11.441
380	HIGH	L6	3	-0.3742	15.052
381	HIGH	V8	4	-0.4479	12.799
382	HIGH	L6	5	-1.2304	24.474
383	HIGH	V6	6	-1.2735	23.937
384	HIGH	V8	7	-0.4243	15.916
385	HIGH	V6	8	-0.8846	25.337
386	HIGH	V6	9	-0.4018	12.281
387	HIGH	V8	10	-0.2924	-4.423
388	HIGH	L4	11	0.4579	-5.207
389	HIGH	L6	12	-0.8098	19.028
390	HIGH	L4	13	-0.0087	-13.330
391	HIGH	L4	14	-0.4600	-20.523
392	HIGH	L4	15	-0.0415	5.470
393	HIGH	L4	16	-0.5689	-10.755
394	HIGH	L4	17	-0.2043	4.757
395	HIGH	L4	18	-0.3889	17.051
396	HIGH	L4	19	-0.1316	-[illegible].405
397	HIGH	V6	20	-0.0043	4.483
398	HIGH	L4	21	-0.0535	8.824
399	HIGH	L4	22	0.0345	1.573
400	HIGH	L4	27	0.1799	-1.777
401	HIGH	L4	29	0.2133	-9.393
402	HIGH	L4	30	-0.3691	16.382
403	HIGH	L4	31	-0.1991	-3.384
404	HIGH	L4	32	0.2749	-10.445
405	HIGH	L4	33	-0.1686	-3.215
406	HIGH	L4	34	-0.4460	6.118
407	HIGH	V6	35	-0.4644	25.111
408	HIGH	L4	36	0.8024	-10.533
409	HIGH	L4	37	-0.0485	7.841
410	HIGH	L4	38	0.0091	5.670
411	LOW	V6	1	-0.4476	16.687
412	LOW	V6	2	-0.1386	0.926
413	LOW	L6	3	-0.3742	20.249
414	LOW	V8	4	-0.4479	19.936
415	LOW	L6	5	-1.2304	52.653
416	LOW	V6	6	-1.2735	41.5[illegible]
417	LOW	V8	7	-0.4243	19.776
418	LOW	V6	8	-0.8846	20.341
419	LOW	V6	9	-0.4018	[illegible]
420	LOW	V8	10	-0.2924	4.041
421	LOW	L4	11	0.4579	[illegible]
422	LOW	L6	12	-0.8098	25.290

1982 CRC ROAD ON PROGRAM
TABULATION OF EFFECTS ON ROAD OCTANE PERFORMANCE
BASED ON MEASURED CONCENTRATIONS

------------------------- OXY=METHANOL GRADE=REGULAR -------------------------

OBS	LEVEL	TYPE	CAR	INTERCEP	EFFECT
423	LOW	L4	13	-0.00868	-20.868
424	LOW	L4	14	-0.45996	-18.209
425	LOW	L4	15	-0.04150	12.437
426	LOW	L4	16	-0.56894	2.981
427	LOW	L4	17	-0.20426	4.522
428	LOW	L4	18	-0.38886	10.981
429	LOW	L4	19	-0.13158	-9.506
430	LOW	V6	20	-0.00434	-6.267
431	LOW	L4	21	-0.05354	3.282
432	LOW	L4	22	0.03452	5.047
433	LOW	L4	23	-0.86396	31.902
434	LOW	L4	24	-0.24850	-4.484
435	LOW	L4	25	-0.17492	31.531
436	LOW	V6	26	-0.60164	-7.099
437	LOW	L4	27	0.17992	-7.884
438	LOW	V6	28	-0.00012	9.782
439	LOW	L4	29	0.21334	12.236
440	LOW	L4	30	-0.36906	20.530
441	LOW	L4	31	-0.19910	-6.005
442	LOW	L4	32	0.27490	-1.740
443	LOW	L4	33	-0.16858	6.533
444	LOW	L4	34	-0.44526	17.360
445	LOW	V6	35	-0.46438	-8.972
446	LOW	L4	36	0.80242	-20.208
447	LOW	L4	37	-0.04846	5.195
448	LOW	L4	38	0.00908	-14.420

1982 CRC ROAD ON PROGRAM
TABULATION OF EFFECTS ON ROAD OCTANE PERFORMANCE
BASED ON MEASURED CONCENTRATIONS

------------------------- OXY=MTB_ETHER GRADE=PREMIUM -------------------------

OBS	LEVEL	TYPE	CAR	INTERCEP	EFFECT
449	HIGH	V6	1	-0.0730	-1.663
450	HIGH	V6	2	0.1617	-3.941
451	HIGH	L6	3	0.1852	-5.548
452	HIGH	V8	4	-0.1074	2.522
453	HIGH	L6	5	-0.7215	9.906
454	HIGH	V6	6	-0.2754	-5.947
455	HIGH	V8	7	-0.1442	-0.489
456	HIGH	V6	8	0.1316	-4.856
457	HIGH	V6	9	-0.7093	11.430
458	HIGH	V8	10	-0.1899	-7.233
459	HIGH	L4	11	0.0098	0.221
460	HIGH	L6	12	0.1593	-5.247
461	HIGH	L4	13	0.1046	-7.508
462	HIGH	L4	14	0.4289	-2.042
463	HIGH	L4	15	0.0604	-1.102
464	HIGH	L4	16	-0.3281	7.236
465	HIGH	L4	17	0.0247	13.159
466	HIGH	L4	18	-0.1183	-2.398
467	HIGH	L4	19	0.0717	7.371
468	HIGH	V6	20	0.2080	-0.259
469	HIGH	L4	21	0.4327	1.695
470	HIGH	L4	22	-0.1404	1.455
471	HIGH	L4	23	0.6302	-16.963
472	HIGH	L4	24	0.7704	-19.411
473	HIGH	L4	25	0.0435	9.378
474	HIGH	V6	26	-1.3838	3.156
475	HIGH	L4	27	-0.8189	12.[illegible]
476	HIGH	V6	28	-1.1888	16.[illegible]
477	HIGH	L4	29	-0.8603	29.[illegible]
478	HIGH	L4	30	-0.2399	-1.133
479	HIGH	L4	31	-0.2394	1.449
480	HIGH	L4	32	-0.3[illegible]	1[illegible].758
481	HIGH	L4	33	0.2749	-4.[illegible]93
482	HIGH	V6	35	0.16[illegible]	0.823
483	HIGH	L4	36	-0.[illegible]	2.[illegible]43
484	HIGH	L4	37	[illegible].354[illegible]	-0.228
485	HIGH	L4	38	1.[illegible]371	-4.[illegible]
486	LOW	V6	1	-[illegible]	-3.[illegible]
487	LOW	V6	2	[illegible].1617	[illegible]
488	LOW	L6	3	[illegible].18[illegible]	-4.221
489	LOW	V8	4	-[illegible]	13.637
490	LOW	L6	[illegible]	-[illegible]	[illegible]
491	LOW	V6	[illegible]	-[illegible]	-[illegible]
492	LOW	V8	[illegible]	-[illegible]	-[illegible]
493	LOW	V6	8	[illegible].1316	1.[illegible]

1982 CRC ROAD ON PROGRAM
TABULATION OF EFFECTS ON ROAD OCTANE PERFORMANCE
BASED ON MEASURED CONCENTRATIONS

---------------------- OXY=MTB_ETHER GRADE=PREMIUM ----------------------

OBS	LEVEL	TYPE	CAR	INTERCEP	EFFECT
494	LOW	V6	9	-0.7093	23.937
495	LOW	V8	10	-0.1899	-4.352
496	LOW	L4	11	0.0098	3.885
497	LOW	L6	12	0.1593	5.070
498	LOW	L4	13	0.1045	-1.528
499	LOW	L4	14	0.4289	17.527
500	LOW	L4	15	0.0604	5.826
501	LOW	L4	16	-0.3281	20.887
502	LOW	L4	17	0.0247	12.196
503	LOW	L4	18	-0.1183	11.452
504	LOW	L4	19	0.0717	12.142
505	LOW	V6	20	0.2080	-3.369
506	LOW	L4	21	0.4327	-39.161
507	LOW	L4	22	-0.1404	13.555
508	LOW	L4	23	0.6302	-20.986
509	LOW	L4	24	0.7704	-41.966
510	LOW	L4	25	0.0435	-7.685
511	LOW	V6	26	-1.3838	45.934
512	LOW	L4	27	-0.8189	-9.861
513	LOW	V6	28	-1.1888	34.708
514	LOW	L4	29	-0.8603	45.119
515	LOW	L4	30	-0.2399	10.240
516	LOW	L4	31	-0.2894	-3.312
517	LOW	L4	32	-0.3860	8.010
518	LOW	L4	33	0.2749	8.119
519	LOW	L4	34	-0.2907	7.094
520	LOW	V6	35	0.1601	3.457
521	LOW	L4	36	-0.0002	19.268
522	LOW	L4	37	0.3540	-11.570
523	LOW	L4	38	1.0321	-5.798

1982 CRC ROAD ON PROGRAM
TABULATION OF EFFECTS ON ROAD OCTANE PERFORMANCE
BASED ON MEASURED CONCENTRATIONS

---------------------- OXY=MTB_ETHER GRADE=REGULAR ----------------------

OBS	LEVEL	TYPE	CAR	INTERCEP	EFFECT
524	HIGH	V6	1	-0.4476	7.646
525	HIGH	V6	2	-0.1386	3.166
526	HIGH	L6	3	-0.3742	16.684
527	HIGH	V8	4	-0.4479	9.393
528	HIGH	L6	5	-1.2304	26.361
529	HIGH	V6	6	-1.2735	20.154
530	HIGH	V8	7	-0.4243	7.933
531	HIGH	V6	8	-0.8846	14.134
532	HIGH	V6	9	-0.4918	9.271
533	HIGH	V8	10	-0.2924	-0.412
534	HIGH	L4	11	0.4579	-0.624
535	HIGH	L6	12	-0.8098	13.606
536	HIGH	L4	13	-0.0087	-7.497
537	HIGH	L4	14	-0.4600	-10.010
538	HIGH	L4	15	-0.0415	4.512
539	HIGH	L4	16	-0.5689	5.245
540	HIGH	L4	17	-0.2043	7.223
541	HIGH	L4	18	-0.3889	10.077
542	HIGH	L4	19	-0.1316	5.463
543	HIGH	V6	20	-0.0043	3.404
544	HIGH	L4	21	-0.0535	21.324
545	HIGH	L4	22	0.0345	6.385
546	HIGH	L4	23	-0.8640	6.352
547	HIGH	L4	24	-0.2485	-9.121
548	HIGH	L4	25	-0.1749	7.770
549	HIGH	V6	26	-0.6016	29.148
550	HIGH	L4	27	0.1799	-0.740
551	HIGH	V6	28	-0.0001	-3.004
552	HIGH	L4	29	0.2133	5.112
553	HIGH	L4	30	-0.3691	16.473
554	HIGH	L4	31	-0.1991	6.526
555	HIGH	L4	32	0.2749	18.305
556	HIGH	L4	33	-0.1686	-3.427
557	HIGH	L4	34	-0.4460	7.397
558	HIGH	V6	35	-0.4644	2.024
559	HIGH	L4	36	0.8024	-12.211
560	HIGH	L4	37	-0.0485	3.622
561	HIGH	L4	38	0.0091	-2.179
562	LOW	V6	1	-0.4476	20.059
563	LOW	V6	2	-0.1386	9.783
564	LOW	L6	3	-0.3742	29.300
565	LOW	V8	4	-0.4479	14.531
566	LOW	L6	5	-1.2[illegible]	[illegible]
567	LOW	V6	6	-1.2[illegible]	[illegible]
568	LOW	V8	7	-0.4243	[illegible]

1982 CRC ROAD ON PROGRAM
TABULATION OF EFFECTS ON ROAD OCTANE PERFORMANCE
BASED ON MEASURED CONCENTRATIONS

-------------------- OXY=MTB_ETHER GRADE=REGULAR --------------------

OBS	LEVEL	TYPE	CAR	INTERCEP	EFFECT
569	LOW	V6	8	-0.88460	26.048
570	LOW	V6	9	-0.40176	7.228
571	LOW	V8	10	-0.29236	15.956
572	LOW	L4	11	0.45736	-40.604
573	LOW	L6	12	-0.80978	26.327
574	LOW	L4	13	-0.00868	19.047
575	LOW	L4	14	-0.45996	-10.736
576	LOW	L4	15	-0.04150	-0.430
577	LOW	L4	16	-0.56894	8.019
578	LOW	L4	17	-0.20426	4.301
579	LOW	L4	18	-0.38836	21.085
580	LOW	L4	19	-0.13158	10.962
581	LOW	V6	20	-0.00434	-7.300
582	LOW	L4	21	-0.05354	22.366
583	LOW	L4	22	0.03452	-12.016
584	LOW	L4	23	-0.86396	18.191
585	LOW	L4	24	-0.24850	-24.476
586	LOW	L4	25	-0.17492	9.542
587	LOW	V6	26	-0.60164	32.600
588	LOW	L4	27	0.17992	-6.294
589	LOW	V6	28	-0.00012	[illegible].252
590	LOW	L4	29	0.21334	-3.259
591	LOW	L4	30	-0.36906	20.943
592	LOW	L4	31	-0.19910	1.651
593	LOW	L4	32	0.27490	20.687
594	LOW	L4	33	-0.15355	3.996
595	LOW	L4	34	-0.44596	9.743
596	LOW	V6	35	-0.46438	20.5[illegible]
597	LOW	L4	36	0.[illegible]0242	-7.49[illegible]
598	LOW	L4	37	-0.04846	-5.100
599	LOW	L4	38	0.00[illegible]	[illegible].792

1982 CRC ROAD ON PROGRAM
TABULATION OF EFFECTS ON ROAD OCTANE PERFORMANCE
BASED ON MEASURED CONCENTRATIONS

------------------------- OXY= MeOH/TBA GRADE=PREMIUM -------------------------

OBS	LEVEL	TYPE	CAR	INTERCEP	EFFECT
600	HIGH	V6	1	-0.0730	-6.[illegible]77
601	HIGH	V6	2	0.1617	-4.672
602	HIGH	L6	3	0.1852	-4.925
603	HIGH	V8	4	-0.1074	2.030
604	HIGH	L6	5	-0.7215	7.599
605	HIGH	V6	6	-0.2754	-15.843
606	HIGH	V8	7	-0.1442	-4.559
607	HIGH	V6	8	0.1316	-9.645
608	HIGH	V6	9	-0.7093	12.962
609	HIGH	V8	10	-0.1899	-16.977
610	HIGH	L4	11	0.0098	-5.430
611	HIGH	L6	12	0.1593	-9.135
612	HIGH	L4	13	0.1046	-0.608
613	HIGH	L4	14	0.4289	8.114
614	HIGH	L4	15	0.0604	6.156
615	HIGH	L4	16	-0.3281	-9.639
616	HIGH	L4	17	0.0247	1.191
617	HIGH	L4	18	-0.1183	-3.779
618	HIGH	L4	19	0.0717	9.601
619	HIGH	V6	20	0.2080	3.887
620	HIGH	L4	21	0.4327	-4.952
621	HIGH	L4	22	-0.1404	3.814
622	HIGH	L4	23	0.6302	-20.361
623	HIGH	L4	24	0.7704	-20.592
624	HIGH	L4	25	0.0435	-0.171
625	HIGH	V6	26	-1.3838	8.095
626	HIGH	L4	27	-0.8189	7.141
627	HIGH	V6	28	-1.18[illegible]	6.111
628	HIGH	L4	29	-0.8603	10.[illegible]
629	HIGH	L4	30	-0.2399	-6.085
630	HIGH	L4	31	-0.2804	-[illegible].563
631	HIGH	L4	32	-0.3860	22.[illegible]
632	HIGH	L4	33	0.2749	-6.[illegible]17
633	HIGH	V6	35	0.1601	-14.24[illegible]
634	HIGH	L4	36	-0.[illegible]	-10.24[illegible]
635	HIGH	L4	37	0.3[illegible]	-10.343
636	HIGH	L4	38	1.0321	-14.1[illegible]

1982 CRC ROAD ON PROGRAM
TABULATION OF EFFECTS ON ROAD OCTANE PERFORMANCE
BASED ON MEASURED CONCENTRATIONS

------------------------- OXY= MeOH/TBA GRADE=REGULAR -------------------------

OBS	LEVEL	TYPE	CAR	INTERCEP	EFFECT
637	HIGH	V6	1	-0.4476	14.240
638	HIGH	V6	2	-0.1336	2.503
639	HIGH	L6	3	-0.3742	15.642
640	HIGH	V8	4	-0.4479	9.011
641	HIGH	L6	5	-1.2304	26.587
642	HIGH	V6	6	-1.2735	26.541
643	HIGH	V8	7	-0.4243	3.772
644	HIGH	V6	8	-0.8846	22.913
645	HIGH	V6	9	-0.4014	11.259
646	HIGH	V8	10	-0.2924	-8.402
647	HIGH	L4	11	0.4579	-3.657
648	HIGH	L6	12	-0.8098	10.746
649	HIGH	L4	13	-0.0087	3.422
650	HIGH	L4	14	-0.4690	-8.502
651	HIGH	L4	15	-0.0415	4.408
652	HIGH	L4	16	-0.5669	6.708
653	HIGH	L4	17	-0.2043	[illegible]
654	HIGH	L4	18	-0.3880	4.633
655	HIGH	L4	19	-0.1316	[illegible]
656	HIGH	V6	20	-0.0041	[illegible]
657	HIGH	L4	21	[illegible]	-3.1[illegible]7
658	HIGH	L4	22	[illegible]	[illegible]
659	HIGH	L4	23	-0.[illegible]	[illegible]
660	HIGH	L4	24	-0.[illegible]	[illegible]
661	HIGH	L4	25	-0.1742	11.306
662	HIGH	V6	26	[illegible]	-1.801
663	HIGH	L4	27	[illegible]	[illegible]
664	HIGH	V6	28	-0.[illegible]	-14.125
665	HIGH	L4	29	[illegible]	-13.443
666	HIGH	L4	30	-0.3691	[illegible]
667	HIGH	L4	31	[illegible]	-1.461
668	HIGH	L4	32	[illegible]	[illegible]
669	HIGH	L4	33	-0.1[illegible]	-1.[illegible]
[illegible]	[illegible]	L4	34	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	L4	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

1982 CRC ROAD ON PROGRAM
TABULATION OF PART-THROTTLE EFFECTS
BASED ON NOMINAL CONCENTRATIONS

------------------------------ OXY=METHANOL ------------------------------

OBS	GRADE	LEVEL	CAR	INTERCEP	EFFECT
73	PREMIUM	HIG	5	0.0993	1.719
74	PREMIUM	HIG	6	0.3182	-10.954
75	PREMIUM	HIG	7	-0.0655	2.455
76	PREMIUM	HIG	23	0.6217	-13.528
77	PREMIUM	HIG	25	0.2326	20.131
78	PREMIUM	HIG	27	-0.6273	-1.649
79	PREMIUM	HIG	35	0.9445	-57.261
80	PREMIUM	HIG	36	-1.4510	10.047
81	PREMIUM	HIG	37	0.3101	-15.034
82	PREMIUM	LOW	5	0.0993	-14.071
83	PREMIUM	LOW	6	0.3182	-11.657
84	PREMIUM	LOW	7	-0.0655	4.877
85	PREMIUM	LOW	23	0.6217	-21.272
86	PREMIUM	LOW	25	0.2326	-12.057
87	PREMIUM	LOW	27	-0.6273	-11.409
88	PREMIUM	LOW	35	0.9445	-73.329
89	PREMIUM	LOW	36	-1.4510	30.975
90	PREMIUM	LOW	37	0.3101	-13.602
91	REGULAR	HIG	5	0.0855	-1.606
92	REGULAR	HIG	6	-0.1374	-[illegible].113
93	REGULAR	HIG	7	-0.0161	6.5[illegible]
94	REGULAR	HIG	27	-0.1912	-5.4[illegible]7
95	REGULAR	HIG	35	-0.45[illegible]	-[illegible]
96	REGULAR	HIG	36	-0.405[illegible]	[illegible].60[illegible]
97	REGULAR	HIG	37	0.3511	[illegible].2[illegible]1
98	REGULAR	LOW	5	0.0855	-2.[illegible]2[illegible]
99	REGULAR	LOW	6	-0.1374	1.[illegible]
100	REGULAR	LOW	7	-0.0161	[illegible]
101	REGULAR	LOW	23	[illegible]	11.[illegible]
102	REGULAR	LOW	[illegible]	-1.[illegible]	[illegible].663
103	REGULAR	LOW	27	-0.1912	-1[illegible].[illegible]
104	REGULAR	LOW	35	-0.45[illegible]	-6.[illegible]7[illegible]
105	REGULAR	LOW	36	-0.405[illegible]	1[illegible].[illegible]
106	REGULAR	LOW	37	0.35[illegible]	-[illegible]

1982 CRC ROAD ON PROGRAM
TABULATION OF PART-THROTTLE EFFECTS
BASED ON NOMINAL CONCENTRATIONS

------------------------------ OXY=ISOPROPANOL ------------------------------

OBS	GRADE	LEVEL	CAR	INTERCEP	EFFECT
37	PREMIUM	HIG	5	0.0993	3.153
38	PREMIUM	HIG	6	0.3182	-11.702
39	PREMIUM	HIG	7	-0.0655	-1.948
40	PREMIUM	HIG	23	0.6217	7.134
41	PREMIUM	HIG	25	0.2326	-15.246
42	PREMIUM	HIG	27	-0.6273	0.024
43	PREMIUM	HIG	35	0.9445	-11.753
44	PREMIUM	HIG	36	-1.4510	21.803
45	PREMIUM	HIG	37	0.3101	-7.297
46	PREMIUM	LOW	5	0.0993	-3.977
47	PREMIUM	LOW	6	0.3182	-14.396
48	PREMIUM	LOW	7	-0.0655	-4.123
49	PREMIUM	LOW	23	0.6217	-49.091
50	PREMIUM	LOW	25	0.2326	3.211
51	PREMIUM	LOW	27	-0.6273	-17.463
52	PREMIUM	LOW	35	0.9445	-20.366
53	PREMIUM	LOW	36	-1.4510	43.012
54	PREMIUM	LOW	37	0.3101	-18.729
55	REGULAR	HIG	5	0.0855	-3.535
56	REGULAR	HIG	6	-0.1378	-1.598
57	REGULAR	HIG	7	-0.0461	[illegible]
58	REGULAR	HIG	23	0.0161	14.331
59	REGULAR	HIG	25	-1.5148	13.54[illegible]
60	REGULAR	HIG	27	-0.1912	-2.[illegible]
61	REGULAR	HIG	35	-0.4508	1.132
62	REGULAR	HIG	36	-0.4089	5.351
63	REGULAR	HIG	37	0.3511	6.106
64	REGULAR	LOW	5	0.0855	3.39[illegible]
65	REGULAR	LOW	6	-0.1378	7.541
66	REGULAR	LOW	7	-0.0461	-[illegible]
67	REGULAR	LOW	23	0.0161	100.153
68	REGULAR	LOW	25	-1.5148	[illegible]
69	REGULAR	LOW	27	-0.1912	7.[illegible]
70	REGULAR	LOW	35	-0.4508	-[illegible]
71	REGULAR	LOW	36	-0.4089	[illegible]
72	REGULAR	LOW	37	0.3511	[illegible]

1982 CRC ROAD ON PROGRAM
TABULATION OF PART-THROTTLE EFFECTS
BASED ON NOMINAL CONCENTRATIONS

OXY=ETHANOL

OBS	GRADE	LEVEL	CAR	INTERCEP	EFFECT
1	PREMIUM	HIG	5	0.0993	-1.71
2	PREMIUM	HIG	6	0.3182	-7.91
3	PREMIUM	HIG	7	-0.0655	7.45
4	PREMIUM	HIG	23	0.6217	-0.14
5	PREMIUM	HIG	25	0.2326	4.93
6	PREMIUM	HIG	27	-0.6273	6.31
7	PREMIUM	HIG	35	0.9445	-17.79
8	PREMIUM	HIG	36	-1.4510	24.82
9	PREMIUM	HIG	37	0.3101	-8.34
10	PREMIUM	LOW	5	0.0993	-21.74
11	PREMIUM	LOW	6	0.3182	-15.64
12	PREMIUM	LOW	7	-0.0655	-2.77
13	PREMIUM	LOW	23	0.6217	-41.23
14	PREMIUM	LOW	25	0.2326	-3.84
15	PREMIUM	LOW	27	-0.6273	-14.46
16	PREMIUM	LOW	35	0.9445	-108.12
17	PREMIUM	LOW	36	-1.4510	40.08
18	PREMIUM	LOW	37	0.3101	-19.30
19	REGULAR	HIG	5	0.0855	-4.18
20	REGULAR	HIG	6	-0.1378	2.25
21	REGULAR	HIG	7	-0.0461	6.34
22	REGULAR	HIG	23	0.0151	0.41
23	REGULAR	HIG	25	-1.5148	20.56
24	REGULAR	HIG	27	-0.1912	-0.66
25	REGULAR	HIG	35	-0.4508	-21.16
26	REGULAR	HIG	36	-0.4059	8.97
27	REGULAR	HIG	37	0.3511	7.25
28	REGULAR	LOW	5	0.0855	3.91
29	REGULAR	LOW	6	-0.1378	2.00
30	REGULAR	LOW	7	-0.0461	21.28
31	REGULAR	LOW	23	0.0151	-1.25
32	REGULAR	LOW	25	-1.5148	-67.12
33	REGULAR	LOW	27	-0.1912	9.57
34	REGULAR	LOW	35	-0.4508	-3.37
35	REGULAR	LOW	36	-0.4059	27.75
36	REGULAR	LOW	37	0.3511	5.54

1982 CRC ROAD ON PROGRAM
TABULATION OF PART-THROTTLE EFFECTS
BASED ON MEASURED CONCENTRATIONS

--------------------------- OXY=T_BUTANOL ---------------------------

OBS	GRADE	LEVEL	CAR	INTERCEP	EFFECT
182	REGULAR	HIG	23	0.0151	18.172
183	REGULAR	HIG	25	-1.5148	24.109
184	REGULAR	HIG	27	-0.1912	21.730
185	REGULAR	HIG	35	-0.4598	-5.633
186	REGULAR	HIG	36	-0.4059	4.511
187	REGULAR	HIG	37	0.3511	-5.895
188	REGULAR	LOW	5	0.0855	-25.276
189	REGULAR	LOW	6	-0.1378	3.153
190	REGULAR	LOW	7	-0.0461	-17.334
191	REGULAR	LOW	23	0.0151	-45.471
192	REGULAR	LOW	25	-1.5148	-0.013
193	REGULAR	LOW	27	-0.1912	16.280
194	REGULAR	LOW	35	-0.4598	39.907
195	REGULAR	LOW	36	-0.4059	6.207
196	REGULAR	LOW	37	0.3511	34.474

1982 CRC ROAD ON PROGRAM
TABULATION OF PART-THROTTLE EFFECTS
BASED ON MEASURED CONCENTRATIONS

------------------------------ OXY= MeOH/TBA ------------------------------

OBS	GRADE	LEVEL	CAR	INTERCEP	EFFECT
143	PREMIUM	HIG	5	0.0993	-22.187
144	PREMIUM	HIG	6	0.3182	-13.755
145	PREMIUM	HIG	7	-0.0655	-1.646
146	PREMIUM	HIG	23	0.6217	-12.860
147	PREMIUM	HIG	25	0.2326	-3.671
148	PREMIUM	HIG	27	-0.6273	-11.362
149	PREMIUM	HIG	35	0.2445	-24.784
150	PREMIUM	HIG	36	-1.4510	16.262
151	PREMIUM	HIG	37	0.3101	-8.616
152	REGULAR	HIG	5	0.0855	-8.484
153	REGULAR	HIG	6	-0.1378	-6.476
154	REGULAR	HIG	7	-0.0461	5.179
155	REGULAR	HIG	23	0.0151	18.410
156	REGULAR	HIG	25	-1.5148	24.488
157	REGULAR	HIG	27	-0.1912	-7.315
158	REGULAR	HIG	35	-0.4598	12.012
159	REGULAR	HIG	36	-0.4059	2.092
160	REGULAR	HIG	37	0.3511	8.465

------------------------------ OXY=T_BUTANOL ------------------------------

OBS	GRADE	LEVEL	CAR	INTERCEP	EFFECT
161	PREMIUM	HIG	5	0.0993	-16.614
162	PREMIUM	HIG	6	0.3182	-3.275
163	PREMIUM	HIG	7	-0.0655	0.995
164	PREMIUM	HIG	23	0.6217	14.684
165	PREMIUM	HIG	25	0.2326	6.35[illegible]
166	PREMIUM	HIG	27	-0.6273	-4.041
167	PREMIUM	HIG	35	0.2445	-12.075
168	PREMIUM	HIG	36	-1.4510	28.838
169	PREMIUM	HIG	37	0.3101	-0.383
170	PREMIUM	LOW	5	0.0993	12.880
171	PREMIUM	LOW	6	0.3182	-6.914
172	PREMIUM	LOW	7	-0.0655	10.876
173	PREMIUM	LOW	23	0.6217	[illegible]
174	PREMIUM	LOW	25	0.2326	-14.60[illegible]
175	PREMIUM	LOW	27	-0.6273	-11.223
176	PREMIUM	LOW	35	0.2445	-12.015
177	PREMIUM	LOW	36	-1.4510	26.219
178	PREMIUM	LOW	37	0.3101	-25.055
179	REGULAR	HIG	5	[illegible]	-4.[illegible]31
180	REGULAR	HIG	6	[illegible]	[illegible]
181	REGULAR	HIG	7	[illegible]	[illegible]

1982 CRC ROAD ON PROGRAM
TABULATION OF PART-THROTTLE EFFECTS
BASED ON MEASURED CONCENTRATIONS

------------------------------ OXY=MTB_ETHER ------------------------------

OBS	GRADE	LEVEL	CAR	INTERCEP	EFFECT
107	PREMIUM	HIG	5	0.0993	0.999
108	PREMIUM	HIG	6	0.3182	-10.102
109	PREMIUM	HIG	7	-0.0655	5.129
110	PREMIUM	HIG	23	0.6217	-15.440
111	PREMIUM	HIG	25	0.2326	9.758
112	PREMIUM	HIG	27	-0.6273	-3.669
113	PREMIUM	HIG	35	0.9445	-16.246
114	PREMIUM	HIG	36	-1.4510	10.476
115	PREMIUM	HIG	37	0.3101	-12.631
116	PREMIUM	LOW	5	0.0993	7.300
117	PREMIUM	LOW	6	0.3182	-1.511
118	PREMIUM	LOW	7	-0.0655	12.280
119	PREMIUM	LOW	23	0.6217	42.207
120	PREMIUM	LOW	25	0.2326	-0.311
121	PREMIUM	LOW	27	-0.6273	-19.966
122	PREMIUM	LOW	35	0.9445	-19.165
123	PREMIUM	LOW	36	-1.4510	37.415
124	PREMIUM	LOW	37	0.3101	-13.507
125	REGULAR	HIG	5	0.0855	-11.218
126	REGULAR	HIG	6	-0.1378	5.150
127	REGULAR	HIG	7	-0.0461	3.110
128	REGULAR	HIG	23	0.0151	20.677
129	REGULAR	HIG	25	-1.5148	12.427
130	REGULAR	HIG	27	-0.1912	-1.298
131	REGULAR	HIG	35	-0.4598	-8.872
132	REGULAR	HIG	36	-0.4059	7.672
133	REGULAR	HIG	37	0.3511	-6.855
134	REGULAR	LOW	5	0.0855	-23.279
135	REGULAR	LOW	6	-0.1378	10.520
136	REGULAR	LOW	7	-0.0461	23.770
137	REGULAR	LOW	23	0.0151	4.994
138	REGULAR	LOW	25	-1.5148	25.351
139	REGULAR	LOW	27	-0.1912	-6.152
140	REGULAR	LOW	35	-0.4598	16.959
141	REGULAR	LOW	36	-0.4059	9.388
142	REGULAR	LOW	37	0.3511	0.866

1982 CRC ROAD ON PROGRAM
TABULATION OF PART-THROTTLE EFFECTS
BASED ON MEASURED CONCENTRATIONS

------------------------------ OXY=METHANOL ------------------------------

OBS	GRADE	LEVEL	CAR	INTERCEP	EFFECT
73	PREMIUM	HIG	5	0.0993	1.754
74	PREMIUM	HIG	6	0.3182	-11.178
75	PREMIUM	HIG	7	-0.0655	2.515
76	PREMIUM	HIG	23	0.6217	-13.805
77	PREMIUM	HIG	25	0.2326	20.541
78	PREMIUM	HIG	27	-0.6273	-1.683
79	PREMIUM	HIG	35	0.9445	-58.430
80	PREMIUM	HIG	36	-1.4510	10.252
81	PREMIUM	HIG	37	0.3101	-18.402
82	PREMIUM	LOW	5	0.0993	-17.160
83	PREMIUM	LOW	6	0.3182	-14.216
84	PREMIUM	LOW	7	-0.0655	5.943
85	PREMIUM	LOW	23	0.6217	-25.941
86	PREMIUM	LOW	25	0.2326	-14.704
87	PREMIUM	LOW	27	-0.6273	-13.914
88	PREMIUM	LOW	35	0.9445	-89.426
89	PREMIUM	LOW	36	-1.4510	37.775
90	PREMIUM	LOW	37	0.3101	-16.588
91	REGULAR	HIG	5	0.0855	-2.064
92	REGULAR	HIG	6	-0.1378	-1.469
93	REGULAR	HIG	7	-0.0461	7.170
94	REGULAR	HIG	27	-0.1912	-6.919
95	REGULAR	HIG	35	-0.4598	-10.078
96	REGULAR	HIG	36	-0.4059	8.487
97	REGULAR	HIG	37	0.3511	0.323
98	REGULAR	LOW	5	0.0855	-2.788
99	REGULAR	LOW	6	-0.1378	2.288
100	REGULAR	LOW	7	-0.0461	4.527
101	REGULAR	LOW	23	0.0151	13.426
102	REGULAR	LOW	25	-1.5148	39.935
103	REGULAR	LOW	27	-0.1912	-17.717
104	REGULAR	LOW	35	-0.4598	-[illegible].578
105	REGULAR	LOW	36	-0.4059	14.572
106	REGULAR	LOW	37	0.3511	-3.176

1982 CRC ROAD ON PROGRAM
TABULATION OF PART-THROTTLE EFFECTS
BASED ON MEASURED CONCENTRATIONS

---------------------------- OXY=ISOPROPANOL ----------------------------

OBS	GRADE	LEVEL	CAR	INTERCEP	EFFECT
37	PREMIUM	HIG	5	0.0993	3.419
38	PREMIUM	HIG	6	0.3182	-12.651
39	PREMIUM	HIG	7	-0.0655	-2.106
40	PREMIUM	HIG	23	0.6217	7.712
41	PREMIUM	HIG	25	0.2326	-16.432
42	PREMIUM	HIG	27	-0.6273	0.026
43	PREMIUM	HIG	35	0.9445	-12.706
44	PREMIUM	HIG	36	-1.4510	23.571
45	PREMIUM	HIG	37	0.3101	-7.889
46	PREMIUM	LOW	5	0.0993	-4.105
47	PREMIUM	LOW	6	0.3182	-15.186
48	PREMIUM	LOW	7	-0.0655	-4.349
49	PREMIUM	LOW	23	0.6217	-51.784
50	PREMIUM	LOW	25	0.2326	3.387
51	PREMIUM	LOW	27	-0.6273	-18.421
52	PREMIUM	LOW	35	0.9445	-21.483
53	PREMIUM	LOW	36	-1.4510	45.371
54	PREMIUM	LOW	37	0.3101	-19.756
55	REGULAR	HIG	5	0.0855	-3.893
56	REGULAR	HIG	6	-0.1378	-1.870
57	REGULAR	HIG	7	-0.0461	8.897
58	REGULAR	HIG	23	0.0151	15.783
59	REGULAR	HIG	25	-1.5148	21.527
60	REGULAR	HIG	27	-0.1912	-2.695
61	REGULAR	HIG	35	-0.4598	1.247
62	REGULAR	HIG	36	-0.4059	5.926
63	REGULAR	HIG	37	0.3511	7.055
64	REGULAR	LOW	5	0.0855	3.860
65	REGULAR	LOW	6	-0.1378	8.559
66	REGULAR	LOW	7	-0.0461	-8.972
67	REGULAR	LOW	23	0.0151	113.810
68	REGULAR	LOW	25	-1.5148	33.760
69	REGULAR	LOW	27	-0.1912	7.964
70	REGULAR	LOW	35	-0.4598	-6.238
71	REGULAR	LOW	36	-0.4059	24.300
72	REGULAR	LOW	37	0.3511	15.409

1982 CRC ROAD ON PROGRAM
TABULATION OF PART-THROTTLE EFFECTS
BASED ON MEASURED CONCENTRATIONS

------------------------------ OXY=ETHANOL ------------------------------

OBS	GRADE	LEVEL	CAR	INTERCEP	EFFECT
1	PREMIUM	HIG	5	0.0993	-2.04
2	PREMIUM	HIG	6	0.3182	-8.36
3	PREMIUM	HIG	7	-0.0655	8.91
4	PREMIUM	HIG	23	0.6217	-0.17
5	PREMIUM	HIG	25	0.2326	5.77
6	PREMIUM	HIG	27	-0.6273	7.53
7	PREMIUM	HIG	35	0.9445	-21.23
8	PREMIUM	HIG	36	-1.4510	29.62
9	PREMIUM	HIG	37	0.3101	-10.00
10	PREMIUM	LOW	5	0.0993	-25.05
11	PREMIUM	LOW	6	0.3182	-18.02
12	PREMIUM	LOW	7	-0.0655	-3.19
13	PREMIUM	LOW	23	0.6217	-47.50
14	PREMIUM	LOW	25	0.2326	-4.42
15	PREMIUM	LOW	27	-0.6273	-16.66
16	PREMIUM	LOW	35	0.9445	-124.56
17	PREMIUM	LOW	36	-1.4510	46.17
18	PREMIUM	LOW	37	0.3101	-22.34
19	REGULAR	HIG	5	0.0855	-4.69
20	REGULAR	HIG	6	-0.1378	2.53
21	REGULAR	HIG	7	-0.0461	7.13
22	REGULAR	HIG	23	0.0151	0.46
23	REGULAR	HIG	25	-1.5148	23.12
24	REGULAR	HIG	27	-0.1912	-0.74
25	REGULAR	HIG	35	-0.4508	-23.77
26	REGULAR	HIG	36	-0.4059	[illegible]
27	REGULAR	HIG	37	0.3511	[illegible]
28	REGULAR	LOW	5	0.0855	4.07
29	REGULAR	LOW	6	-0.1378	[illegible]
30	REGULAR	LOW	7	-0.0461	22.17
31	REGULAR	LOW	23	0.0151	-1.30
32	REGULAR	LOW	25	-1.5148	-69.91
33	REGULAR	LOW	27	-0.1912	[illegible]
34	REGULAR	LOW	35	-0.4508	-3.51
35	REGULAR	LOW	36	-0.4059	28.91
36	REGULAR	LOW	37	0.3511	[illegible]

APPENDIX H

OXYGENATE EFFECTS: PART-THROTTLE RESULTS

1982 CRC ROAD ON PROGRAM
TABULATION OF EFFECTS ON ROAD OCTANE PERFORMANCE
BASED ON MEASURED CONCENTRATIONS

OXY=T_BUTANOL GRADE=REGULAR

OBS	LEVEL	TYPE	CAR	INTERCEP	EFFECT
796	LOW	V6	8	-0.88460	19.703
797	LOW	V6	9	-0.40176	4.487
798	LOW	V8	10	-0.29236	2.036
799	LOW	L4	11	0.45786	-6.098
800	LOW	L4	12	-0.80278	16.502
801	LOW	L4	13	-0.00868	6.497
802	LOW	L4	14	-0.45296	-11.887
803	LOW	L4	15	-0.04150	-1.772
804	LOW	L4	16	-0.56824	8.401
805	LOW	L4	17	-0.20426	12.260
806	LOW	L4	18	-0.38886	31.320
807	LOW	L4	19	-0.13158	4.340
808	LOW	V6	20	-0.00434	-3.341
809	LOW	L4	21	-0.05354	15.283
810	LOW	L4	22	0.03452	0.465
811	LOW	L4	23	-0.86396	10.930
812	LOW	L4	24	-0.24850	-2.652
813	LOW	L4	25	-0.17492	22.348
814	LOW	V6	26	-0.60164	29.002
815	LOW	L4	27	0.17992	2.863
816	LOW	V6	28	-0.00012	5.232
817	LOW	L4	29	0.21334	-2.795
818	LOW	L4	30	-0.36906	20.052
819	LOW	L4	31	-0.19910	-2.418
820	LOW	L4	32	0.27490	11.489
821	LOW	L4	33	-0.16858	1.994
822	LOW	L4	34	-0.44596	0.347
823	LOW	V6	35	-0.45438	30.123
824	LOW	L4	36	0.80242	-4.053
825	LOW	L4	37	-0.04846	-15.494
826	LOW	L4	38	0.00908	4.752

1982 CRC ROAD ON PROGRAM
TABULATION OF EFFECTS ON ROAD OCTANE PERFORMANCE
BASED ON MEASURED CONCENTRATIONS

OXY=T_BUTANOL GRADE=REGULAR

OBS	LEVEL	TYPE	CAR	INTERCEP	EFFECT
751	HIGH	V6	1	-0.4476	9.022
752	HIGH	V6	2	-0.1386	4.438
753	HIGH	L6	3	-0.3742	12.725
754	HIGH	V8	4	-0.4479	12.791
755	HIGH	L6	5	-1.2304	22.782
756	HIGH	V6	6	-1.2735	29.168
757	HIGH	V8	7	-0.4243	10.874
758	HIGH	V6	8	-0.8846	15.757
759	HIGH	V6	9	-0.4018	-3.512
760	HIGH	V8	10	-0.2924	-4.830
761	HIGH	L4	11	0.4579	-6.828
762	HIGH	L6	12	-0.8098	13.841
763	HIGH	L4	13	-0.0087	3.455
764	HIGH	L4	14	-0.4600	-2.289
765	HIGH	L4	15	-0.0415	10.565
766	HIGH	L4	16	-0.5689	5.454
767	HIGH	L4	17	-0.2043	-6.493
768	HIGH	L4	18	-0.3889	6.428
769	HIGH	L4	19	-0.1316	-0.615
770	HIGH	V6	20	-0.0043	-0.756
771	HIGH	L4	21	-0.0535	-1.209
772	HIGH	L4	22	0.0345	-11.008
773	HIGH	L4	23	-0.8640	-19.465
774	HIGH	L4	24	-0.2485	-6.920
775	HIGH	L4	25	-0.1749	12.674
776	HIGH	V6	26	-0.6016	30.733
777	HIGH	L4	27	0.1799	7.955
778	HIGH	V6	28	-0.0001	-5.855
779	HIGH	L4	29	0.2133	-8.571
780	HIGH	L4	30	-0.3691	13.722
781	HIGH	L4	31	-0.1991	-4.363
782	HIGH	L4	32	0.2749	6.147
783	HIGH	L4	33	-0.1686	6.013
784	HIGH	L4	34	-0.4460	10.395
785	HIGH	V6	35	-0.4644	-0.587
786	HIGH	L4	36	0.[illegible]024	-7.791
787	HIGH	L4	37	-0.[illegible]465	-6.985
788	HIGH	L4	38	0.0091	5.962
789	LOW	V6	1	-0.4476	15.714
790	LOW	V6	2	-0.1386	8.255
791	LOW	L6	3	-0.3742	29.679
792	LOW	V8	4	-0.4479	25.[illegible]
793	LOW	L6	5	-1.2304	41.[illegible]
794	LOW	V6	6	-1.2735	42.[illegible]
795	LOW	V8	7	-0.4243	2.[illegible]

1982 CRC ROAD ON PROGRAM
TABULATION OF EFFECTS ON ROAD OCTANE PERFORMANCE
BASED ON MEASURED CONCENTRATIONS

------------------------ OXY=T_BUTANOL GRADE=PREMIUM ------------------------

OBS	LEVEL	TYPE	CAR	INTERCEP	EFFECT
720	LOW	V6	8	0.1316	0.922
721	LOW	V6	9	-0.7093	19.000
722	LOW	V8	10	-0.1899	16.554
723	LOW	L4	11	0.0098	0.956
724	LOW	L6	12	0.1593	0.078
725	LOW	L4	13	0.1046	6.676
726	LOW	L4	14	0.4289	-1.194
727	LOW	L4	15	0.0604	4.749
728	LOW	L4	16	-0.3281	7.371
729	LOW	L4	17	0.0247	23.342
730	LOW	L4	18	-0.1183	1.869
731	LOW	L4	19	0.0717	11.106
732	LOW	V6	20	0.2080	-3.788
733	LOW	L4	21	0.4327	-27.635
734	LOW	L4	22	-0.1404	6.558
735	LOW	L4	23	0.6302	-11.351
736	LOW	L4	24	0.7704	-30.815
737	LOW	L4	25	0.0435	5.513
738	LOW	V6	26	-1.3838	6.363
739	LOW	L4	27	-0.8189	-0.601
740	LOW	V6	28	-1.1888	28.547
741	LOW	L4	29	-0.8003	33.502
742	LOW	L4	30	-0.2399	17.743
743	LOW	L4	31	-0.2894	-1.350
744	LOW	L4	32	-0.3860	7.212
745	LOW	L4	33	0.2749	10.291
746	LOW	L4	34	-0.2907	0.899
747	LOW	V6	35	0.1601	8.792
748	LOW	L4	36	-0.0002	-19.023
749	LOW	L4	37	0.3540	-7.025
750	LOW	L4	38	1.0321	-41.065

1982 CRC ROAD ON PROGRAM
TABULATION OF EFFECTS ON ROAD OCTANE PERFORMANCE
BASED ON MEASURED CONCENTRATIONS

------------------------ OXY=T_BUTANOL GRADE=PREMIUM ------------------------

OBS	LEVEL	TYPE	CAR	INTERCEP	EFFECT
675	HIGH	V6	1	-0.0730	4.683
676	HIGH	V6	2	0.1617	1.399
677	HIGH	L6	3	0.1852	-3.570
678	HIGH	V8	4	-0.1074	0.796
679	HIGH	L6	5	-0.7215	13.285
680	HIGH	V6	6	-0.2754	-3.574
681	HIGH	V8	7	-0.1442	-3.631
682	HIGH	V6	8	0.1316	4.713
683	HIGH	V6	9	-0.7093	17.411
684	HIGH	V8	10	-0.1899	-2.522
685	HIGH	L4	11	0.0098	0.439
686	HIGH	L6	12	0.1593	0.257
687	HIGH	L4	13	0.1046	-1.671
688	HIGH	L4	14	0.4289	3.736
689	HIGH	L4	15	0.0604	4.894
690	HIGH	L4	16	-0.3281	12.968
691	HIGH	L4	17	0.0247	-2.405
692	HIGH	L4	18	-0.1183	3.778
693	HIGH	L4	19	0.0717	5.932
694	HIGH	V6	20	0.2080	9.474
695	HIGH	L4	21	0.4327	-9.261
696	HIGH	L4	22	-0.1404	-1.640
697	HIGH	L4	23	0.6302	9.016
698	HIGH	L4	24	0.7704	26.779
699	HIGH	L4	25	0.0435	10.650
700	HIGH	V6	26	-1.3338	10.907
701	HIGH	L4	27	-0.8189	16.446
702	HIGH	V6	28	-1.1856	15.482
703	HIGH	L4	29	-0.8603	24.1[illegible]
704	HIGH	L4	30	-0.2399	7.075
705	HIGH	L4	31	-0.2894	-[illegible].028
706	HIGH	L4	32	-0.3860	4.901
707	HIGH	L4	33	0.2749	-1.937
708	HIGH	L4	34	-0.2907	1.187
709	HIGH	V6	35	0.1601	9.45[illegible]
710	HIGH	L4	36	-0.0002	[illegible]
711	HIGH	L4	37	0.3540	-[illegible]
712	HIGH	L4	38	1.0321	-1[illegible].74[illegible]
713	LOW	V6	1	-0.0730	[illegible]
714	LOW	V6	2	0.1617	-[illegible]
715	LOW	L6	3	0.1852	-[illegible]
716	LOW	V8	4	-0.1074	1[illegible].36[illegible]
717	LOW	L6	5	-0.7215	[illegible]
718	LOW	V6	6	-0.2754	-1[illegible]
719	LOW	V8	7	-0.144[illegible]	[illegible]

1982 CRC ROAD ON PROGRAM
TABULATION OF PART-THROTTLE EFFECTS
BASED ON NOMINAL CONCENTRATIONS

------------------------------ OXY=MTB_ETHER ------------------------------

OBS	GRADE	LEVEL	CAR	INTERCEP	EFFECT
107	PREMIUM	HIG	5	0.0993	0.955
108	PREMIUM	HIG	6	0.3182	-9.658
109	PREMIUM	HIG	7	-0.0655	4.003
110	PREMIUM	HIG	23	0.6217	-14.770
111	PREMIUM	HIG	25	0.2326	8.373
112	PREMIUM	HIG	27	-0.6273	-3.508
113	PREMIUM	HIG	35	0.9445	-15.532
114	PREMIUM	HIG	36	-1.4510	10.015
115	PREMIUM	HIG	37	0.3101	-12.076
116	PREMIUM	LOW	5	0.0993	5.651
117	PREMIUM	LOW	6	0.3182	-1.360
118	PREMIUM	LOW	7	-0.0655	11.052
119	PREMIUM	LOW	23	0.6217	37.986
120	PREMIUM	LOW	25	0.2326	-0.280
121	PREMIUM	LOW	27	-0.6273	-17.962
122	PREMIUM	LOW	35	0.9445	-17.248
123	PREMIUM	LOW	36	-1.4510	33.674
124	PREMIUM	LOW	37	0.3101	-12.157
125	REGULAR	HIG	5	0.0855	-10.882
126	REGULAR	HIG	6	-0.1378	4.996
127	REGULAR	HIG	7	-0.0461	3.017
128	REGULAR	HIG	23	0.0151	20.057
129	REGULAR	HIG	25	-1.5148	12.054
130	REGULAR	HIG	27	-0.1912	-1.259
131	REGULAR	HIG	35	-0.4558	-8.606
132	REGULAR	HIG	36	-0.4059	7.442
133	REGULAR	HIG	37	0.3511	-6.649
134	REGULAR	LOW	5	0.0855	-20.627
135	REGULAR	LOW	6	-0.1378	10.226
136	REGULAR	LOW	7	-0.0461	23.105
137	REGULAR	LOW	23	0.0151	4.458
138	REGULAR	LOW	25	-1.5148	24.641
139	REGULAR	LOW	27	-0.1912	-5.978
140	REGULAR	LOW	35	-0.4558	16.475
141	REGULAR	LOW	36	-0.4059	9.126
142	REGULAR	LOW	37	0.3511	0.441

1982 CRC ROAD ON PROGRAM
TABULATION OF PART-THROTTLE EFFECTS
BASED ON NOMINAL CONCENTRAIONS

------------------------------ OXY= MeOH/TBA ------------------------------

OBS	GRADE	LEVEL	CAR	INTERCEP	EFFECT
143	PREMIUM	HIG	5	0.0993	-21.522
144	PREMIUM	HIG	6	0.3182	-13.342
145	PREMIUM	HIG	7	-0.0655	-1.527
146	PREMIUM	HIG	23	0.6217	-12.474
147	PREMIUM	HIG	25	0.2326	-3.560
148	PREMIUM	HIG	27	-0.6273	-11.021
149	PREMIUM	HIG	35	0.9445	-24.041
150	PREMIUM	HIG	36	-1.4510	15.774
151	PREMIUM	HIG	37	0.3101	-8.357
152	REGULAR	HIG	5	0.0855	-7.500
153	REGULAR	HIG	6	-0.1378	-5.725
154	REGULAR	HIG	7	-0.0461	4.579
155	REGULAR	HIG	23	0.0151	16.274
156	REGULAR	HIG	25	-1.5148	21.647
157	REGULAR	HIG	27	-0.1912	-6.467
158	REGULAR	HIG	35	-0.4598	10.618
159	REGULAR	HIG	36	-0.4059	1.770
160	REGULAR	HIG	37	0.3511	7.483

------------------------------ OXY=T_BUTANOL ------------------------------

OBS	GRADE	LEVEL	CAR	INTERCEP	EFFECT
161	PREMIUM	HIG	5	0.0993	-14.487
162	PREMIUM	HIG	6	0.3182	-2.856
163	PREMIUM	HIG	7	-0.0655	0.702
164	PREMIUM	HIG	23	0.6217	12.908
165	PREMIUM	HIG	25	0.2326	5.537
166	PREMIUM	HIG	27	-0.6273	-3.504
167	PREMIUM	HIG	35	0.9445	-10.530
168	PREMIUM	HIG	36	-1.4510	25.146
169	PREMIUM	HIG	37	0.3101	-8.710
170	PREMIUM	LOW	5	0.0993	11.449
171	PREMIUM	LOW	6	0.3182	-6.171
172	PREMIUM	LOW	7	-0.0655	0.702
173	PREMIUM	LOW	23	0.6217	8.013
174	PREMIUM	LOW	25	0.2326	-13.030
175	PREMIUM	LOW	27	-0.6273	-10.[illegible]
176	PREMIUM	LOW	35	0.9445	-11.5[illegible]
177	PREMIUM	LOW	36	-1.4510	23.387
178	PREMIUM	LOW	37	0.3101	-23.429
179	REGULAR	HIG	5	0.0855	-4.0[illegible]
180	REGULAR	HIG	6	-0.13[illegible]	4.3[illegible]
181	REGULAR	HIG	7	-0.0461	[illegible]

1982 CRC ROAD ON PROGRAM
TABULATION OF PART-THROTTLE EFFECTS
BASED ON NOMINAL CONCENTRAIONS

------------------------------ OXY=T_BUTANOL ------------------------------

OBS	GRADE	LEVEL	CAR	INTERCEP	EFFECT
182	REGULAR	HIG	23	0.0151	15.628
183	REGULAR	HIG	25	-1.5148	20.734
184	REGULAR	HIG	27	-0.1912	18.730
185	REGULAR	HIG	35	-0.4598	-4.844
186	REGULAR	HIG	36	-0.4059	3.880
187	REGULAR	HIG	37	0.3511	-5.070
188	REGULAR	LOW	5	0.0855	-23.254
189	REGULAR	LOW	6	-0.1378	2.901
190	REGULAR	LOW	7	-0.0461	-15.918
191	REGULAR	LOW	23	0.0151	-41.833
192	REGULAR	LOW	25	-1.5148	-0.012
193	REGULAR	LOW	27	-0.1912	14.977
194	REGULAR	LOW	35	-0.4598	36.715
195	REGULAR	LOW	36	-0.4059	5.710
196	REGULAR	LOW	37	0.3511	31.716

APPENDIX I

RAW DATA: INDIVIDUAL ROAD OCTANE VALUES

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
HAX 228L3	26	35	F	8.5	V6	Y	7666	+10	D	1	1-24-83	3	72	29.95	70						
										2	1-25-83	3	68	29.60	49						

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
1	1	1.0	2350	87.5			
1	2	0.0	2400	87.0			
2	1	4.0	2275	88.8			
2	2	4.0	2300	88.8			
3	1	2.0	2400	88.0			
3	2	2.5	2400	88.3			
4	1						
4	2						
5	1	3.0	2375	88.5			
5	2	5.0	2375	89.4			
6	1	2.5	2425	88.3			
6	2	3.5	2375	88.7			
7	1	2.0	2400	88.0			
7	2	2.0	2375	88.0			
8	1	6.0	2500	89.8			
8	2	5.0	2420	89.4			
9	1	4.0	2375	88.8			
9	2	4.0	2420	88.8			
10	1	7.0	2525	90.3			
10	2	7.0	2500	90.3			
11	1	5.0	2375	89.4			
11	2	6.0	2400	89.8			
12	1	8.0	2350	90.7			
12	2	9.0	2350	91.8			
13	1	2.5	2275	88.3			
13	2	3.0	2350	88.5			
14	1	6.0	2400	89.8			
14	2	5.0	2450	89.4			
15	1	9.0	2275	91.8			
15	2	10.0	2400	92.5			
16	1	7.0	2270	90.3			
16	2	8.0	2350	90.7			
17	1	10.0	2400	92.5			
17	2	9.5	2425	92.0			
18	1	7.0	2350	90.3			
18	2	7.0	2475	90.3			
19	1	8.0	2550	90.7			
19	2	7.5	2500	90.5			
20	1	8.0	2475	90.7			
20	2	11.0	2500	92.7			

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1	10.0	2475	92.5			
21	2	12.0	2450	93.0			
22	1	7.0	2600	90.3			
22	2	6.0	2550	89.8			
23	1	8.5	2620	91.0			
23	2	7.5	2400	90.5			
24	1	10.0	2450	92.5			
24	2	9.0	2550	91.8			
25	1	8.0	2375	90.7			
25	2	8.0	2400	90.7			
26	1	7.0	2500	90.3			
26	2	9.0	2475	91.8			
27	1	7.5	2425	90.5			
27	2	8.5	2375	91.0			
28	1	7.0	2400	90.3			
28	2	8.5	2425	91.0			

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
HJG 218L3	18	26	F	9.0	L4	Y	10889	+12	D	1	11-5-82	3	70	30.10	65						
										2	11-8-82	3	70	30.08	66						

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	RPM	ROAD O.N.	PART THROTTLE SPK ADV	RPM	ROAD O.N.
1	1	2.0	2100	88.0			
1	2	0.0	2150	87.0			
2	1	30.0	2150	89.0			
2	2	4.0	2150	89.8			
3	1	3.0	2150	89.0			
3	2	3.0	2050	89.4			
4	1	7.0	2100	90.6			
4	2	7.0	2100	91.0			
5	1	4.0	2100	89.4			
5	2	4.0	2100	89.8			
6	1	5.0	2150	89.8			
6	2	6.0	2100	90.6			
7	1	3.0	2100	89.0			
7	2	3.0	2100	89.4			
8	1	5.0	2100	89.8			
8	2	5.0	2100	90.2			
9	1	4.0	2150	89.4			
9	2	3.0	2100	89.4			
10	1	2.0	2100	88.0			
10	2	4.0	2150	89.8			
11	1	4.0	2100	89.4			
11	2	4.0	2100	89.8			
12	1	6.0	2150	90.2			
12	2	6.0	2050	90.6			
13	1	4.0	2100	89.4			
13	2	4.0	2100	89.8			
14	1	8.0	2100	91.0			
14	2	8.0	2150	91.3			
15	1	11.0	2150	92.2			
15	2	12.0	2100	92.7			
16	1	10.0	2100	91.8			
16	2	8.0	2100	91.3			
17	1	11.0	2100	92.2			
17	2	9.0	2150	91.7			
18	1	7.0	2150	90.6			
18	2	11.0	2100	92.3			
19	1	11.0	2150	92.2			
19	2	11.0	2150	92.3			
20	1	9.0	2150	91.4			
20	2	9.0	2100	91.7			

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1	12.0	2100	92.6			
21	2	10.0	2150	92.0			
22	1	10.0	2100	91.8			
22	2	8.0	2100	91.3			
23	1	10.0	2100	91.8			
23	2	11.0	2100	92.3			
24	1	11.0	2100	92.2			
24	2	11.0	2100	92.3			
25	1	10.0	2100	91.8			
25	2	12.0	2150	92.7			
26	1	10.0	2100	91.8			
26	2	11.0	2100	92.3			
27	1	1.0	2150	87.0			
27	2	3.0	2100	89.4			
28	1	8.0	2200	91.0			
28	2	10.0	2150	92.0			

MODEL CODE	CAR NO	LAB NO	EN CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
HJG 218M4	29	47	C	9.0	L4	Y	22000	+12	D	1	2-8-83	4	70	30.05	50						
										2	2-10-83	4	70	30.01	50						

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
1	1	13.0	2850	86.4			
1	2	13.0	2850	86.4			
2	1	16.0	2850	89.0			
2	2	16.0	2850	89.0			
3	1	16.0	2850	89.0			
3	2	16.0	2850	89.0			
4	1	16.0	2850	89.0			
4	2	16.0	2850	89.0			
5	1	16.0	2850	89.0			
5	2	16.0	2850	89.0			
6	1	17.0	2850	90.0			
6	2	17.0	2850	90.0			
7	1	15.0	2850	88.0			
7	2	15.0	2850	88.0			
8	1	16.0	2850	89.0			
8	2	16.0	2850	89.0			
9	1	14.0	2850	87.0			
9	2	14.0	2850	87.0			
10	1	14.0	2850	87.0			
10	2	14.0	2850	87.0			
11	1	15.0	2850	88.0			
11	2	15.0	2850	88.0			
12	1	17.0	2850	90.0			
12	2	17.0	2850	90.0			
13	1	15.0	2850	88.0			
13	2	15.0	2850	88.0			
14	1	19.0	2850	91.0			
14	2	19.0	2850	91.0			
15	1	23.0	2850	95.0			
15	2	23.0	2850	95.0			
16	1	22.0	2850	94.0			
16	2	22.0	2850	94.0			
17	1	23.0	2850	95.0			
17	2	23.0	2850	95.0			
18	1	22.0	2850	94.0			
18	2	22.0	2850	94.0			
19	1	23.0	2850	95.0			
19	2	23.0	2850	95.0			
20	1	22.0	2850	94.0			
20	2	22.0	2850	94.0			

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1	22.0	2850	94.0			
21	2	22.0	2850	94.0			
22	1	21.0	2850	93.0			
22	2	21.0	2850	93.0			
23	1	22.0	2850	94.0			
23	2	22.0	2850	94.0			
24	1	22.0	2850	94.0			
24	2	22.0	2850	94.0			
25	1	24.0	2850	96.0			
25	2	24.0	2850	96.0			
26	1	22.0	2850	94.0			
26	2	22.0	2850	94.0			
27	1	13.0	2850	86.4			
27	2	13.0	2850	86.4			
28	1	19.0	2850	91.0			
28	2	19.0	2850	91.0			

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
IGA 238L3	1	8	F	8.0	V6	Y	21067	+15	D	1	10-13-82	3	80	29.86	45						
										2	10-15-82	3	80	29.34	45						

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
1	1	-1.6	1900	86.5			
1	2	-0.8	1900	86.4			
2	1	1.3	1900	87.9			
2	2	3.8	1900	88.7			
3	1	2.7	1900	88.5			
3	2	4.3	1900	88.9			
4	1	6.2	1900	90.4			
4	2	6.8	1900	89.9			
5	1	4.3	1900	89.4			
5	2	3.2	1900	88.5			
6	1	5.6	1900	90.1			
6	2	6.8	1900	89.9			
7	1	2.9	1900	88.7			
7	2	1.8	1900	87.8			
8	1	4.4	1900	89.5			
8	2	5.7	1900	89.5			
9	1	2.0	1900	88.2			
9	2	0.7	1900	87.2			
10	1	2.2	1900	88.3			
10	2	2.5	1900	88.1			
11	1	4.2	1900	89.3			
11	2	3.0	1900	88.4			
12	1	5.4	1900	90.0			
12	2	4.3	1900	88.9			
13	1	5.5	1900	90.0			
13	2	5.8	1900	89.5			
14	1	7.0	2000	90.8			
14	2	9.1	1900	91.2			
15	1	9.7	1900	92.2			
15	2	10.9	1900	92.4			
16	1	8.3	2000	91.5			
16	2	9.8	1900	91.6			
17	1	10.7	2000	92.6			
17	2	11.4	1900	92.8			
18	1	10.2	2000	92.4			
18	2	9.7	1900	91.6			
19	1	9.8	2000	92.2			
19	2	10.6	1900	92.2			
20	1	9.7	2000	92.2			
20	2	9.2	1900	91.2			

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1	9.9	2000	92.3			
21	2	9.7	1900	91.6			
22	1	9.3	2000	92.0			
22	2	9.2	1900	91.2			
23	1	9.4	2000	92.0			
23	2	10.5	1900	92.1			
24	1	9.0	2000	91.8			
24	2	9.3	1900	91.3			
25	1	10.3	2000	92.5			
25	2	10.7	1900	92.3			
26	1	10.1	2000	92.4			
26	2	9.2	1900	91.2			
27	1	2.0	1900	88.2			
27	2	1.3	1900	87.6			
28	1	9.5	2000	92.1			
28	2	8.4	1900	90.7			

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
KKB 222M4	23	28	F	8.5	L4	Y	19900	+12	D	1	2-15-83	4	85	28.86	74	2-15-83	4		85	28.86	74
										2	2-17-83	4	85	29.46	74	2-17-83	4		85	29.46	74

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	RPM	ROAD O.N.	PART THROTTLE SPK ADV	RPM	ROAD O.N.
1	1	17.5	2514	85.8	36.8	2130	83.1
1	2	18.9	2438	85.6	20.9	1686	79.6
2	1	21.9	2350	88.4			
2	2	24.7	2466	88.4	32.2	1831	85.0
3	1	22.7	2631	88.9	40.1	2158	84.4
3	2	23.5	2538	87.5	25.5	1724	82.3
4	1						
4	2						
5	1	19.0	2502	86.7	34.1	1969	83.3
5	2	21.9	2450	87.1	25.1	1700	81.9
6	1	22.1	2637	88.6	38.4	2099	84.2
6	2	26.6	2512	88.9	28.5	1685	83.5
7	1	21.0	2641	87.9	37.7	2085	84.0
7	2	24.0	2470	87.6	49.7	1996	90.6
8	1	21.1	2508	88.1	41.8	2168	85.0
8	2	23.6	2426	87.7	30.1	1910	84.3
9	1	19.2	2401	86.8	38.3	2160	83.6
9	2	21.6	2473	86.5	16.2	1675	75.6
10	1	10.6	2427	81.7	38.4	2013	84.8
10	2	26.2	2629	88.0	25.4	1770	82.3
11	1	21.5	2645	88.2	34.8	1940	83.9
11	2	22.9	2582	87.0	23.6	1723	81.3
12	1	21.7	2640	88.3	41.0	2086	85.3
12	2	24.5	2354	88.4	31.6	2923	84.7
13	1	21.3	2630	88.1	39.0	2016	85.1
13	2	24.4	2428	88.1	30.0	1711	84.2
14	1	25.0	2394	90.1	41.9	2076	85.7
14	2	30.2	2541	90.5	33.9	1728	85.7
15	1	28.2	2599	91.6	44.0	2040	86.5
15	2	28.1	2652	88.6			
16	1	26.5	2634	90.8	43.5	2062	86.3
16	2	30.2	2630	89.8	30.6	1805	84.6
17	1	27.4	2557	91.2	42.7	2150	85.4
17	2	31.7	2470	91.1	37.0	1896	86.9
18	1	26.6	2558	90.8	41.8	2042	85.8
18	2	26.9	2516	89.0	26.7	1805	82.9
19	1	27.0	2560	91.1	41.6	1998	86.0
19	2	32.3	2468	91.8	41.2	1741	88.2
20	1	17.6	2355	85.7	34.4	1967	83.4
20	2	30.3	2582	90.3	30.2	1650	84.2

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1	27.8	2458	91.4	42.6	1975	86.4
21	2	31.2	2471	90.9	43.4	2115	88.7
22	1	24.0	2484	89.5	43.5	2097	86.0
22	2	30.9	2469	90.7	35.8	1755	86.4
23	1	27.0	2556	91.1	46.3	2038	87.1
23	2	33.1	2466	92.2	39.8	1659	87.6
24	1	24.1	2597	89.6			
24	2	30.1	2581	90.2	42.0	2106	88.2
25	1	26.9	2592	91.0	46.0	2058	86.9
25	2	25.4	2401	88.9	29.1	1712	83.8
26	1	24.7	2622	89.9	45.1	2044	86.8
26	2	26.2	2358	89.2	29.6	1744	84.1
27	1	18.4	2640	86.3	33.2	2036	82.0
27	2	22.5	2580	86.8	25.7	2068	82.2
28	1	25.7	2514	90.4	34.1	2108	81.7
28	2	28.0	2470	89.8	30.5	1970	84.4

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1	8.6	2100	92.9			
21	2	10.3	2100	93.5			
22	1	8.2	2100	92.6			
22	2	8.8	2100	92.8			
23	1	7.8	2100	92.5			
23	2	9.3	2100	93.1			
24	1	8.8	2100	92.9			
24	2	9.7	2100	93.2			
25	1	9.5	2100	93.3			
25	2	10.3	1700	93.5			
26	1	10.2	2100	93.6			
26	2	9.5	2100	93.1			
27	1	1.9	1700	89.6			
27	2	3.5	1700	90.0			
28	1	7.7	2100	92.4			
28	2	7.5	2100	92.1			

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
MCB 133A3	3	8	F	8.6	L6	Y	7004	+10	D	1	10-5-82	3	80	29.97	64						
										2	10-6-82	3	80	30.02	59						

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
1	1	-1.2	1700	87.8			
1	2	1.2	1700	88.6			
2	1	2.5	1700	89.9			
2	2	3.6	1700	90.0			
3	1	3.2	2100	90.3			
3	2	4.8	1700	90.7			
4	1	6.3	2100	91.8			
4	2	6.2	2100	91.5			
5	1	4.2	1700	90.8			
5	2	5.4	1700	91.0			
6	1	5.8	2100	91.5			
6	2	6.3	2100	91.5			
7	1	3.1	1700	90.2			
7	2	4.2	1700	90.4			
8	1	5.1	2100	91.2			
8	2	4.9	2100	90.8			
9	1	3.0	1700	90.2			
9	2	3.2	1700	89.8			
10	1	3.2	1700	90.3			
10	2	3.4	1700	89.9			
11	1	3.5	1700	90.4			
11	2	5.5	1700	91.1			
12	1	5.8	1700	91.5			
12	2	7.2	2100	92.0			
13	1	6.7	1700	91.9			
13	2	5.2	1700	90.9			
14	1	8.3	2100	92.7			
14	2	8.3	2100	92.5			
15	1	9.4	2100	93.2			
15	2	10.5	2100	93.6			
16	1	9.7	2100	93.4			
16	2	9.1	2100	93.0			
17	1	9.7	2100	93.4			
17	2	11.2	2100	93.9			
18	1	8.9	2100	93.0			
18	2	9.2	2100	93.0			
19	1	9.5	2100	93.3			
19	2	10.2	2100	93.5			
20	1	7.8	1900	92.5			
20	2	8.8	2100	92.8			

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1	29.0	2750	90.0	28.0	1500	92.4
21	2	28.0	2700	90.5	30.0	1600	92.9
22	1	30.0	2750	90.2	27.0	1500	92.2
22	2	26.0	2700	89.9	27.0	1600	92.0
23	1	32.0	2750	90.8	26.0	1500	91.9
23	2	29.0	2700	90.8	27.0	1600	92.0
24	1	28.0	2750	89.7	28.0	1500	92.4
24	2	27.0	2700	90.2	27.0	1600	92.0
25	1	31.0	2750	90.5	28.0	1500	92.4
25	2	29.0	2700	90.8	29.0	1600	92.8
26	1	26.0	2750	89.1	25.0	1500	91.7
26	2	24.0	2700	89.3	25.0	1600	91.4
27	1	18.0	2750	86.4	14.0	1500	88.5
27	2	18.0	2700	86.8	15.0	1600	88.3
28	1	34.0	2750	91.3	29.0	1500	92.7
28	2	31.0	2700	91.3	30.0	1600	92.9

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
LXX 228L3	35	4	F	8.5	V6	Y	6884	+15	D	1	2-14-83	3	75	29.24	23	2-16-83	3		75	29.13	40
										2	2-15-83	3	73	29.10	35	2-17-83	3		74	29.08	33

FUEL NO	RUN NO	FU - THROTTLE SPK ADV	RPM	ROAD O.N.	PART THROTTLE SPK ADV	RPM	ROAD O.N.
1	1	18.0	2750	86.4	6.0	1500	86.0
1	2	17.0	2700	86.4	8.0	1600	86.2
2	1	19.0	2750	86.6	7.0	1500	86.3
2	2	18.0	2700	86.8	9.0	1600	86.5
3	1	19.0	2750	86.8	9.0	1500	87.0
3	2	18.0	2700	86.8	14.0	1600	88.0
4	1	28.0	2750	89.7	12.0	1500	87.9
4	2	25.0	2700	89.6	15.0	1600	88.3
5	1	27.0	2750	89.4	11.0	1500	87.6
5	2	23.0	2700	88.9	13.0	1600	87.8
6	1	25.0	2750	88.8	8.0	1500	86.7
6	2	23.0	2700	88.9	12.0	1600	87.5
7	1	23.0	2750	88.1	9.0	1500	87.0
7	2	21.0	2700	88.0	12.0	1600	87.5
8	1	26.0	2750	89.1	14.0	1500	88.5
8	2	23.0	2700	88.9	17.0	1600	88.9
9	1	24.0	2750	88.5	15.0	1500	88.8
9	2	21.0	2700	88.0	15.0	1600	88.3
10	1	20.0	2750	87.1	9.0	1500	87.0
10	2	19.0	2700	87.3	9.0	1600	86.5
11	1	23.0	2750	88.1	13.0	1500	88.2
11	2	22.0	2700	88.5	16.0	1600	88.6
12	1	22.0	2750	87.8	12.0	1500	87.9
12	2	23.0	2700	88.9	13.0	1600	87.8
13	1	21.0	2750	87.5	18.0	1500	89.7
13	2	22.0	2700	88.5	18.0	1600	89.3
14	1	25.0	2750	88.8	27.0	1500	92.2
14	2	26.0	2700	89.9	28.0	1600	92.3
15	1	26.0	2750	89.1	24.0	1500	91.4
15	2	26.0	2700	89.9	26.0	1600	91.7
16	1	26.0	2750	89.1	17.0	1500	89.4
16	2	25.0	2700	89.6	19.0	1600	89.6
17	1	34.0	2750	91.3	14.0	1500	88.5
17	2	30.0	2700	91.0	16.0	1600	88.6
18	1	27.0	2750	89.4	11.0	1500	87.6
18	2	28.0	2700	90.5	15.0	1600	88.0
19	1	27.0	2750	89.4	28.0	1500	92.4
19	2	24.0	2700	89.3	27.0	1600	92.0
20	1	33.0	2750	91.0	26.0	1500	91.9
20	2	30.0	2700	91.0	27.0	1600	92.0

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1	11.0	2000	89.7	14.0	1650	89.0
21	2	11.0	2150	89.7	12.0	1550	88.3
22	1	10.5	2275	89.4	10.5	1575	87.6
22	2	10.0	2300	89.2	10.0	1600	87.5
23	1	12.5	2150	90.8	11.5	1625	88.0
23	2	12.5	2100	90.8	10.0	1590	87.5
24	1	9.0	2100	88.5	9.5	1680	87.3
24	2	11.0	2100	89.7	10.0	1600	87.5
25	1	13.0	2150	91.6	14.0	1625	89.0
25	2	12.0	2250	90.4	10.0	1600	87.5
26	1	12.0	2250	90.4	9.5	1550	87.3
26	2	12.0	1950	90.4	10.0	1575	87.5
27	1	10.0	2000	89.2	9.5	1600	87.3
27	2	9.5	2150	88.8	9.5	1600	87.3
28	1	9.5	2250	88.8	10.0	1580	87.5
28	2	10.0	1950	89.2	10.0	1625	87.5

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
LXR F25L3	27	35	F	8.2	L4	Y	23281	+ 8	D	1	1-15-83	3	72	29.65	100	1-15-83	3		72	29.65	100
										2	1-16-83	3	68	29.70	63	1-16-83	3		68	29.70	63

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	RPM	ROAD O.N.	PART THROTTLE SPK ADV	RPM	ROAD O.N.
1	1	8.0	1950	88.0	5.0	1550	85.6
1	2	8.0	2100	88.0	6.0	1500	86.0
2	1	9.5	2000	88.8	10.0	1675	87.5
2	2	9.5	2250	88.8	10.0	1700	87.5
3	1	9.0	2150	88.5	6.0	1590	86.0
3	2	9.0	2100	88.5	6.0	1575	86.0
4	1	10.0	2150	89.2	7.0	1600	86.3
4	2	10.0	2150	89.2	9.5	1625	87.3
5	1	9.0	2275	88.5	9.0	1650	87.0
5	2	9.0	2050	88.5	9.5	1600	87.3
6	1	10.0	2250	89.2	9.5	1580	87.3
6	2	9.5	2200	88.8	10.0	1575	87.5
7	1	8.5	2175	88.3	8.5	1550	86.8
7	2	9.5	2220	88.8	8.0	1670	86.7
8	1	9.5	2175	88.8	9.5	1550	87.3
8	2	11.0	2000	89.7	7.0	1500	86.3
9	1	8.5	1950	88.3	8.0	1600	86.7
9	2	8.5	2000	88.3	8.5	1575	86.8
10	1	9.5	2150	88.8	12.0	1625	88.3
10	2	10.0	2075	89.2	11.0	1500	87.8
11	1	8.0	2100	88.0	6.0	1690	86.0
11	2	9.0	2000	88.5	7.0	1600	86.3
12	1	9.5	2250	88.8	8.0	1700	86.7
12	2	9.5	2150	88.8	8.0	1700	86.7
13	1	8.5	2000	90.0	6.5	1680	86.2
13	2	8.0	2150	88.0	7.0	1590	86.3
14	1	10.0	2275	89.2	10.0	1600	87.5
14	2	10.0	2250	89.2	12.0	1625	88.3
15	1	14.0	2000	92.0	15.0	1550	89.5
15	2	12.5	1950	90.8	16.0	1650	90.0
16	1	10.0	1950	89.2	12.0	1575	88.3
16	2	10.5	2000	89.4	10.0	1625	87.5
17	1	14.0	2150	92.0	14.0	1550	89.0
17	2	13.0	2275	91.6	14.0	1600	89.0
18	1	10.5	2150	89.4	11.0	1650	87.8
18	2	10.0	2275	89.2	10.0	1600	87.5
19	1	11.5	2300	90.0	15.0	1625	89.5
19	2	13.0	2100	91.2	15.0	1750	89.5
20	1	10.0	2200	89.2	11.0	1700	87.8
20	2	10.0	2150	89.2	9.0	1690	87.0

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1	12.4	1900	93.8			
21	2	10.7	1900	92.7			
22	1	8.9	1900	92.4			
22	2	8.6	1900	91.7			
23	1	9.7	1900	92.7			
23	2	10.5	1900	92.6			
24	1	10.6	1900	93.2			
24	2	11.0	1900	92.8			
25	1	10.1	1900	92.9			
25	2	11.4	1900	93.0			
26	1	10.0	1900	92.8			
26	2	10.9	1900	92.8			
27	1	1.8	1900	89.1			
27	2	2.8	1900	88.2			
28	1	8.0	1900	91.9			
28	2	8.9	1900	91.8			

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
LGA 238L3	2	8	F	8.0	V6	Y	12362	+15	D	1	9-28-82	3	80	29.85	64						
										2	9-29-82	3	80	30.08	74						

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	RPM	ROAD O.N.	PART THROTTLE SPK ADV	RPM	ROAD O.N.
1	1	-0.5	1900	88.3			
1	2	2.3	1900	87.8			
2	1	1.8	1900	89.1			
2	2	4.9	1900	89.7			
3	1	2.7	1900	89.5			
3	2	4.3	1900	89.3			
4	1	6.3	1900	91.1			
4	2	7.3	1900	91.0			
5	1	3.4	1900	89.7			
5	2	5.2	1900	89.9			
6	1	4.9	1900	90.4			
6	2	6.9	1900	90.8			
7	1	1.9	1900	89.2			
7	2	5.1	1900	89.8			
8	1	4.5	1900	90.2			
8	2	4.6	1900	90.6			
9	1	1.8	1900	89.1			
9	2	3.5	1900	88.7			
10	1	1.5	1900	89.0			
10	2	4.7	1900	89.6			
11	1	3.0	1900	89.6			
11	2	4.9	1900	89.7			
12	1	4.3	1900	90.1			
12	2	6.4	1900	90.6			
13	1	4.4	1900	90.2			
13	2	5.3	1900	89.9			
14	1	7.8	1900	91.9			
14	2	9.2	1900	92.0			
15	1	10.2	1900	93.0			
15	2	11.3	1900	92.9			
16	1	9.3	1900	92.6			
16	2	9.9	1900	92.3			
17	1	11.6	1900	93.6			
17	2	12.5	1900	93.5			
18	1	10.1	1900	92.9			
18	2	10.9	1900	92.8			
19	1	10.8	1900	93.2			
19	2	12.4	1900	93.4			
20	1	10.4	1900	93.1			
20	2	10.8	1900	92.7			

		FULL THROTTLE			PART THROTTLE		
FUEL NO	RUN NO	SPK ADV	RPM	ROAD O.N.	SPK ADV	RPM	ROAD O.N.
21	1	28.0	1850	90.9	32.0	1600	91.2
21	2	33.0	1850	92.2	31.0	1600	91.8
22	1	34.0	1850	92.9	30.0	1600	90.6
22	2	34.0	1850	92.5	31.0	1600	91.6
23	1	31.0	1850	92.0	28.0	1600	90.0
23	2	33.0	1850	92.2	29.0	1600	91.2
24	1	32.0	1850	92.3	32.0	1600	91.2
24	2	32.0	1850	91.8	33.0	1600	92.3
25	1	31.0	1850	92.0	30.0	1600	90.6
25	2	36.0	1850	93.1	31.0	1600	91.8
26	1	29.0	1850	91.3	32.0	1600	91.2
26	2	32.0	1850	91.6	32.0	1600	92.0
27	1	20.0	1850	87.0	23.0	1600	88.3
27	2	21.0	1850	87.4	23.0	1600	89.1
28	1	31.0	1850	92.0	31.0	1600	90.9
28	2	33.0	1850	92.2	32.0	1600	92.0

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
LBY 450L4	10	7	F	8.0	V8	Y	13763	+20	D	1	1-3-83	3	72	30.25	34	1-5-83	3	5.0	69	30.34	46
										2	1-4-83	3	69	30.66	28	1-6-83	3	5.0	70	30.10	44

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
1	1	22.0	1850	87.1	28.0	1600	89.6
1	2	24.0	1850	88.0	25.0	1400	88.9
2	1	27.0	1850	90.0	27.0	1600	89.3
2	2	30.0	1850	89.9	25.0	1600	88.9
3	1	25.0	1850	89.0	28.0	1600	89.6
3	2	28.0	1850	89.3	26.0	1400	89.2
4	1	26.0	1850	89.6	29.0	1600	89.9
4	2	28.0	1850	89.3	28.0	1400	89.9
5	1	26.0	1850	89.6	29.0	1600	89.9
5	2	29.0	1850	89.6	26.0	1400	89.2
6	1	25.0	1850	89.0	27.0	1600	89.3
6	2	26.0	1850	88.7	28.0	1400	89.9
7	1	23.0	1850	87.8	25.0	1600	88.6
7	2	26.0	1850	88.7	27.0	1400	89.6
8	1	25.0	1850	89.0	32.0	1600	90.6
8	2	30.0	1850	89.9	27.0	1400	89.6
9	1	23.0	1850	87.8	27.0	1600	89.3
9	2	26.0	1850	88.7	26.0	1400	89.2
10	1	23.0	1850	87.8	26.0	1600	89.0
10	2	26.0	1850	88.7	27.0	1400	89.6
11	1	27.0	1850	90.0	26.0	1600	89.0
11	2	28.0	1850	89.3	26.0	1400	89.2
12	1	27.0	1850	90.0	29.0	1600	89.9
12	2	30.0	1850	89.9	29.0	1400	90.2
13	1	25.0	1850	89.0	27.0	1600	89.3
13	2	26.0	1850	88.7	28.0	1400	89.9
14	1	31.0	1850	91.8	30.0	1600	90.2
14	2	35.0	1850	91.3	29.0	1400	90.2
15	1	34.0	1850	92.9	29.0	1600	90.3
15	2	39.0	1850	94.1	31.0	1600	91.8
16	1	30.0	1850	91.6	30.0	1600	90.6
16	2	33.0	1850	92.2	29.0	1600	91.2
17	1	28.0	1850	90.8	30.0	1600	90.6
17	2	30.0	1850	91.1	32.0	1600	92.0
18	1	27.0	1850	90.4	29.0	1600	90.3
18	2	29.0	1850	90.8	27.0	1600	90.6
19	1	29.0	1850	91.3	31.0	1600	90.9
19	2	32.0	1850	91.8	32.0	1600	92.0
20	1	32.0	1850	92.3	29.0	1600	90.3
20	2	31.0	1850	91.5	31.0	1600	91.8

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1	29.0	1200	95.2	35.0	1400	97.3
21	2	29.0	1200	96.6	39.0	1200	98.5
22	1	27.0	1200	94.4	34.0	1400	97.8
22	2	26.0	1200	95.1	36.0	1200	97.8
23	1	29.0	1200	95.2	38.0	1400	98.4
23	2	28.0	1200	96.1	38.0	1200	98.3
24	1	28.0	1200	94.8	37.0	1400	98.0
24	2	28.0	1200	96.1	39.0	1200	98.5
25	1	31.0	1200	95.8	37.0	1400	98.0
25	2	30.0	1200	97.0	41.0	1200	99.0
26	1	31.0	1200	95.8	40.0	1400	99.1
26	2	30.0	1200	97.0	36.0	1200	97.8
27	1	21.0	1200	91.5	25.0	1400	93.4
27	2	18.0	1200	90.7	26.0	1200	94.8
28	1	27.0	1200	94.4	39.0	1400	98.8
28	2	23.0	1200	93.6	39.0	1200	98.5

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
LAE 230L3	9	7	F	8.5	V6	Y	9013	+15	D	1	12-7-82	3	71	30.54	60	12-9-82	3	5.0	74	30.43	51
										2	12-8-82	3	71	30.74	44	12-10-82	3	5.0	70	30.37	44

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	RPM	ROAD O.N.	PART THROTTLE SPK ADV	RPM	ROAD O.N.
1	1	17.0	1300	88.0	26.0	1400	94.6
1	2	15.0	1200	88.3	27.0	1200	95.4
2	1	19.0	1300	89.8	31.0	1400	96.8
2	2	18.0	1200	90.4	29.0	1200	96.4
3	1	20.0	1300	90.5	32.0	1400	96.9
3	2	20.0	1200	91.6	28.0	1200	95.9
4	1	22.0	1300	92.0	30.0	1400	96.3
4	2	22.0	1200	92.9	28.0	1200	95.9
5	1	20.0	1300	90.5	31.0	1400	96.6
5	2	20.0	1200	91.6	28.0	1200	95.9
6	1	22.0	1300	92.0	35.0	1400	97.7
6	2	22.0	1200	92.9	31.0	1200	97.4
7	1	19.0	1300	89.8	30.0	1400	96.3
7	2	17.0	1200	89.7	28.0	1200	95.8
8	1	23.0	1300	92.7	31.0	1400	96.6
8	2	22.0	1200	92.9	31.0	1200	97.4
9	1	18.0	1300	88.9	28.0	1400	95.5
9	2	16.0	1200	89.0	31.0	1200	97.4
10	1	18.0	1300	88.9	29.0	1400	96.0
10	2	16.0	1200	89.0	29.0	1200	96.4
11	1	19.0	1300	89.8	29.0	1400	96.0
11	2	18.0	1200	90.4	26.0	1200	94.9
12	1	21.0	1300	91.3	34.0	1400	97.5
12	2	21.0	1200	92.2	30.0	1200	96.9
13	1	21.0	1300	91.3	32.0	1400	96.9
13	2	21.0	1200	92.2	28.0	1200	95.9
14	1	25.0	1300	94.0	34.0	1400	97.5
14	2	22.0	1200	92.9	30.0	1200	96.9
15	1	30.0	1200	95.5	37.0	1400	98.0
15	2	29.0	1200	96.6	37.0	1200	98.0
16	1	29.0	1200	95.2	36.0	1400	97.7
16	2	29.0	1200	96.6	37.0	1200	98.0
17	1	32.0	1200	96.3	36.0	1400	97.7
17	2	29.0	1200	96.6	38.0	1200	98.3
18	1	30.0	1200	95.5	38.0	1400	98.4
18	2	28.0	1200	96.1	34.0	1200	97.3
19	1	31.0	1200	95.8	38.0	1400	98.4
19	2	30.0	1200	97.0	34.0	1200	97.3
20	1	27.0	1200	94.4	38.0	1400	98.4
20	2	27.0	1200	95.6	39.0	1200	98.5

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1	30.0	2450	92.9			
21	2	30.0	2450	92.4			
22	1	29.0	2450	91.3			
22	2	29.0	2450	92.0			
23	1	31.0	2450	92.0			
23	2	29.0	2450	92.0			
24	1	31.0	2450	92.0			
24	2	29.0	2450	92.0			
25	1	32.0	2450	94.0			
25	2	34.0	2450	94.0			
26	1	33.0	2350	94.4			
26	2	35.0	2450	94.5			
27	1	21.0	2450	88.0			
27	2	20.0	2450	88.2			
28	1	29.0	2450	91.3			
28	2	28.0	2450	90.7			

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
KLB 222A3	32	5	F	8.5	L4	Y	14478	+12	D	1	2-10-83	3	71	30.18	56						
										2	2-16-83	3	71	30.10	64						

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	RPM	ROAD O.N.	PART THROTTLE SPK ADV	RPM	ROAD O.N.
1	1	19.0	2450	87.6			
1	2	20.0	2450	88.2			
2	1	23.0	2450	88.7			
2	2	21.0	2450	89.1			
3	1	25.0	2450	89.3			
3	2	21.0	2350	89.1			
4	1	23.0	2450	89.5			
4	2	21.0	2350	89.1			
5	1	23.0	2450	88.7			
5	2	21.0	2350	89.1			
6	1	28.0	2450	90.4			
6	2	22.0	2350	89.6			
7	1	23.0	2450	88.7			
7	2	21.0	2450	88.4			
8	1	25.0	2450	89.4			
8	2	24.0	2350	90.3			
9	1	23.0	2450	88.7			
9	2	21.0	2350	89.1			
10	1	22.0	2450	89.0			
10	2	22.0	2350	89.6			
11	1	28.0	2450	90.4			
11	2	24.0	2350	90.3			
12	1	32.0	2450	92.0			
12	2	27.0	2350	91.4			
13	1	26.0	2450	90.2			
13	2	25.0	2350	90.7			
14	1	29.0	2450	91.3			
14	2	28.0	2450	90.7			
15	1	30.0	2450	92.9			
15	2	34.0	2450	93.6			
16	1	29.0	2450	92.0			
16	2	30.0	2450	91.6			
17	1	32.0	2450	93.0			
17	2	34.0	2450	93.6			
18	1	29.0	2450	92.3			
18	2	33.0	2450	93.2			
19	1	32.0	2450	94.0			
19	2	33.0	2450	93.2			
20	1	30.0	2450	92.3			
20	2	30.0	2450	92.4			

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
NAX 228L3	20	26	F	8.5	V6	Y	5332	+10	D	1	11-19-82	3	70	29.84	70						
										2	11-23-82	3	70	29.88	65						

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	RPM	ROAD O.N.	PART THROTTLE SPK ADV	RPM	ROAD O.N.
1	1	6.0	2200	87.3			
1	2	3.0	2100	87.6			
2	1	7.0	2300	87.5			
2	2	5.0	2200	88.1			
3	1	8.0	2700	87.8			
3	2	6.0	2100	87.3			
4	1	12.0	2650	89.3			
4	2	8.0	2200	87.8			
5	1	8.0	2000	87.8			
5	2	6.0	2100	88.4			
6	1	9.0	2300	88.0			
6	2	7.0	2100	88.7			
7	1	5.0	2650	87.0			
7	2	2.0	2100	87.3			
8	1	10.0	2100	88.6			
8	2	5.0	2150	88.1			
9	1	7.0	2200	87.5			
9	2	3.0	2300	87.6			
10	1	8.0	2100	87.8			
10	2	4.0	2150	87.9			
11	1	7.0	2100	87.4			
11	2	8.0	2100	87.8			
12	1	13.0	2050	89.5			
12	2	9.0	2150	88.0			
13	1	9.0	2150	88.2			
13	2	5.0	2700	88.1			
14	1	11.0	2450	89.0			
14	2	8.0	2100	89.0			
15	1	14.0	2400	89.5			
15	2	13.0	2100	89.0			
16	1	14.0	2700	89.3			
16	2	8.0	2300	89.0			
17	1	15.0	2600	89.7			
17	2	12.0	2100	90.1			
18	1	15.0	2100	90.0			
18	2	8.0	2100	89.0			
19	1	16.0	2050	90.3			
19	2	11.0	2100	89.9			
20	1	14.0	2600	89.3			
20	2	11.0	2200	89.9			

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1	18.0	2050	90.8			
21	2	9.0	2300	89.3			
22	1	13.0	2050	89.5			
22	2	11.0	2400	88.5			
23	1	17.0	2050	90.5			
23	2	11.0	2350	89.9			
24	1	10.0	2150	88.3			
24	2	11.0	2100	89.9			
25	1	15.0	2300	90.0			
25	2	14.0	2200	89.3			
26	1	20.0	2700	91.3			
26	2	12.0	2150	88.8			
27	1	5.0	2100	86.6			
27	2	2.0	2100	87.3			
28	1	15.0	2450	90.0			
28	2	7.0	2650	88.7			

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
NAX 228L3	28	35	F	8.5	V6	Y	16000	+10	D	1	12-20-82	3	65	29.31	48						
										2	12-20-82	3	65	29.31	48						

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
1	1	-1.0	2470	85.4			
1	2	-1.0	2400	85.4			
2	1	1.0	2300	86.5			
2	2	2.0	2550	87.0			
3	1	1.0	2415	86.5			
3	2	2.0	2450	87.0			
4	1						
4	2						
5	1	0.5	2400	86.3			
5	2	0.0	2325	86.0			
6	1	1.0	2350	86.5			
6	2	2.5	2575	87.3			
7	1	0.0	2300	86.0			
7	2	-1.0	2375	85.4			
8	1	1.5	2450	86.8			
8	2	3.0	2500	87.5			
9	1	-1.5	2350	85.0			
9	2	2.0	2450	87.0			
10	1	-1.5	2400	85.0			
10	2	0.0	2325	86.0			
11	1	-1.0	2420	85.4			
11	2	2.0	2425	87.0			
12	1	1.0	2375	86.5			
12	2	1.0	2400	86.5			
13	1	-1.0	2340	85.4			
13	2	-1.0	2400	85.4			
14	1	1.0	2300	86.5			
14	2	2.0	2520	87.0			
15	1	7.0	2350	89.5			
15	2	8.0	2250	90.0			
16	1	3.0	2375	87.5			
16	2	6.0	2400	89.0			
17	1	4.0	2375	88.0			
17	2	5.0	2400	88.5			
18	1	2.0	2380	87.0			
18	2	3.5	2500	87.7			
19	1	4.0	2480	88.0			
19	2	6.0	2500	89.0			
20	1	2.5	2370	87.3			
20	2	4.0	2350	88.0			

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1	7.0	2380	89.5			
21	2	6.0	2400	89.0			
22	1	4.0	2550	88.0			
22	2	5.0	2620	88.5			
23	1	5.0	2350	88.5			
23	2	5.0	2400	88.5			
24	1	5.0	2380	88.5			
24	2	6.0	2450	89.0			
25	1	5.0	2380	88.5			
25	2	8.0	2575	90.0			
26	1	4.0	2375	88.0			
26	2	5.0	2350	88.5			
27	1	-1.0	2360	85.4			
27	2	0.0	2350	86.0			
28	1	3.0	2310	87.5			
28	2	4.0	2375	88.0			

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
NBJ 244L3	4	8	F	8.3	V8	Y	6019	+ 2	D	1	10-19-82	3	80	30.20	45						
										2	10-21-82	3	80	29.88	54						

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	RPM	ROAD O.N.	PART THROTTLE SPK ADV	RPM	ROAD O.N.
1	1	-1.5	1900	86.6			
1	2	-0.3	1900	86.8			
2	1	2.3	1900	88.4			
2	2	1.8	1900	87.9			
3	1	3.1	1900	88.7			
3	2	2.7	1900	88.3			
4	1	5.8	1900	89.5			
4	2	4.5	1900	88.9			
5	1	4.3	1900	89.0			
5	2	2.5	1900	88.2			
6	1	4.6	1900	89.1			
6	2	4.7	1900	89.0			
7	1	2.2	1900	88.4			
7	2	2.2	1900	88.0			
8	1	3.3	1900	88.8			
8	2	4.1	1900	88.8			
9	1	2.0	1900	88.3			
9	2	2.4	1900	88.1			
10	1	2.8	1900	88.6			
10	2	2.5	1900	88.2			
11	1	2.7	1900	88.5			
11	2	2.0	1900	87.9			
12	1	4.6	1900	89.1			
12	2	4.6	1900	88.9			
13	1	4.3	1900	89.0			
13	2	3.3	1900	88.5			
14	1	6.3	1900	89.7			
14	2	6.2	1900	89.5			
15	1	8.5	1900	90.5			
15	2	8.3	1900	90.3			
16	1	8.9	1900	90.6			
16	2	7.4	1900	89.9			
17	1	9.4	1900	90.8			
17	2	8.3	1900	90.3			
18	1	8.4	1900	90.4			
18	2	7.3	1900	89.9			
19	1	8.0	1900	90.3			
19	2	8.4	1900	90.3			
20	1	7.8	1900	90.2			
20	2	6.8	1900	89.7			

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1	9.3	1900	90.8			
21	2	8.0	1900	90.2			
22	1	9.8	1900	91.0			
22	2	8.2	1900	90.2			
23	1	10.4	1900	91.3			
23	2	8.8	1900	90.4			
24	1	9.6	1900	90.9			
24	2	8.7	1900	90.4			
25	1	9.8	1900	91.0			
25	2	9.2	1900	90.6			
26	1	9.3	1900	90.8			
26	2	9.3	1900	90.6			
27	1	0.9	1900	87.8			
27	2	1.7	1900	87.8			
28	1	6.9	1900	89.9			
28	2	7.9	1900	90.1			

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
NBJ 244L4	7	29	F	8.3	V8	Y	10250	+ 2	D	1	11-1-82	3	70	29.72	61	11-1-82	3		70	29.72	61
										2	11-4-82	3	70	29.50	38	11-4-82	3		70	29.50	38

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	RPM	ROAD O.N.	PART THROTTLE SPK ADV	RPM	ROAD O.N.
1	1	1.5	1650	88.3	4.5	1650	81.8
1	2	-0.5	1650	87.8	2.7	1600	81.7
2	1	3.7	1700	89.4	6.5	1600	83.4
2	2	3.9	1750	89.9	4.5	1550	83.3
3	1	5.2	1700	90.2	6.2	1600	83.2
3	2	3.6	1700	89.8	3.7	1700	82.7
4	1	8.2	2000	91.6	8.5	1600	84.4
4	2	5.1	1750	90.5	4.9	1750	83.5
5	1	3.5	1600	89.3	7.2	1550	83.8
5	2	4.0	1800	90.0	5.9	1500	84.2
6	1	7.2	1650	91.1	7.5	1650	84.1
6	2	6.4	1750	91.0	6.4	1600	84.5
7	1	3.5	1600	89.3	5.5	1550	82.7
7	2	2.5	1650	89.2	3.2	1650	82.2
8	1	6.5	1700	90.8	8.0	1600	84.2
8	2	4.7	1700	90.2	5.9	1700	84.2
9	1	2.0	1650	88.5	4.5	1650	81.8
9	2	1.4	1750	88.7	2.2	1700	81.2
10	1	4.2	1650	89.7	7.2	1650	83.8
10	2	3.6	1650	89.8	4.8	1650	83.5
11	1	4.5	1700	89.8	8.0	1600	84.2
11	2	2.5	1700	89.3	5.2	1600	83.8
12	1	6.7	1650	90.8	9.7	1600	85.0
12	2	4.8	1750	90.3	4.6	1650	83.3
13	1	5.2	1700	90.2	7.5	1550	84.0
13	2	3.2	1800	89.6	5.1	1500	83.7
14	1	8.7	1700	91.8	11.0	1600	85.4
14	2	6.1	1700	90.9	5.4	1700	83.9
15	1	10.5	1750	92.6	11.7	1650	85.8
15	2	9.7	1750	92.3	11.0	1700	86.7
16	1	9.2	1850	92.0	11.2	1600	85.5
16	2	6.9	1800	91.3	7.6	1750	85.2
17	1	8.5	1900	91.7	11.5	1650	85.6
17	2	9.0	2000	92.1	9.7	1700	86.2
18	1	10.2	1800	92.4	9.5	1600	84.8
18	2	9.0	1800	92.1	8.2	1700	85.5
19	1	9.5	1750	92.1	12.7	1650	86.0
19	2	9.1	1850	92.1	11.2	1650	86.8
20	1	9.2	1800	92.0	11.0	1600	85.4
20	2	8.6	1800	91.9	6.2	1650	84.4

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1	8.5	1700	91.7	10.0	1600	85.1
21	2	8.0	2000	91.7	9.3	1750	86.0
22	1	9.0	1650	91.9	12.2	1600	85.8
22	2	7.4	1800	91.4	7.8	1750	85.2
23	1	8.2	1800	91.6	9.7	1600	85.0
23	2	7.5	1800	91.5	9.1	1650	85.9
24	1	7.7	1700	86.3	12.5	1650	85.9
24	2	9.9	1750	92.4	8.5	1700	85.6
25	1	9.2	1750	92.0	13.5	1650	86.2
25	2	11.6	2100	93.0	11.5	1700	87.0
26	1	9.2	1950	92.0	12.5	1600	85.9
26	2	9.0	1900	92.1	9.2	1550	86.0
27	1	2.2	1800	88.6	3.5	1600	80.7
27	2	2.3	1800	89.2	1.1	1700	80.0
28	1	9.5	2000	92.1	12.5	1650	85.8
28	2	8.3	1800	91.8	7.2	1700	85.0

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
NBK 238L3	8	29	F	8.6	V6	Y	19330	+ 6	D	1	11-5-82	3	70	29.47	28						
										2	11-6-82	3	70	29.55	50						

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	RPM	ROAD O.N.	PART THROTTLE SPK ADV	RPM	ROAD O.N.
1	1	-0.7	1550	86.8			
1	2	-0.4	1900	86.6			
2	1	3.7	1800	90.1			
2	2	3.0	1750	90.6			
3	1	2.3	1800	89.1			
3	2	2.5	1800	89.2			
4	1	4.5	1800	90.7			
4	2	6.5	1900	91.7			
5	1	3.7	1750	90.2			
5	2	2.7	1700	89.6			
6	1	6.5	1600	91.7			
6	2	4.9	1900	90.9			
7	1	2.7	1800	89.4			
7	2	2.5	1650	89.3			
8	1	4.3	1600	90.4			
8	2	4.0	1750	90.3			
9	1	0.7	1750	88.0			
9	2	1.6	1600	88.4			
10	1	2.1	1550	89.2			
10	2	2.2	1800	89.1			
11	1	2.3	1600	89.3			
11	2	2.7	1700	89.4			
12	1	4.5	1600	90.7			
12	2	4.2	1850	90.4			
13	1	5.3	1800	91.1			
13	2	4.7	1750	90.7			
14	1	7.5	1750	92.3			
14	2	6.7	1700	91.8			
15	1	9.2	1900	93.2			
15	2	9.5	1700	93.3			
16	1	9.5	1750	93.2			
16	2	9.9	1900	93.4			
17	1	10.7	1700	93.8			
17	2	11.1	1900	94.0			
18	1	8.3	1800	92.7			
18	2	9.5	1650	93.2			
19	1	10.3	1800	93.6			
19	2	10.9	1600	93.8			
20	1	8.0	1750	92.5			
20	2	7.0	1700	92.0			

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1	10.2	1800	93.6			
21	2	9.0	1700	93.0			
22	1	7.0	1900	92.0			
22	2	9.0	1850	93.0			
23	1	9.4	1750	93.2			
23	2	9.5	1700	93.2			
24	1	8.3	1800	92.6			
24	2	9.2	1700	93.1			
25	1	9.5	1800	93.2			
25	2	9.7	1700	93.4			
26	1	8.8	1900	92.8			
26	2	8.5	1850	92.7			
27	1	0.5	1850	87.7			
27	2	0.7	1650	87.6			
28	1	6.7	1900	91.8			
28	2	7.4	1600	92.2			

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
NJG 218L3	24	28	F	9.0	L4	Y	26737	+12	D	1	1-26-83	3	85	28.95	74	1-26-83	3		85	28.95	74
										2	2-1-83	3	85	29.70	74	2-1-83	3		85	29.70	74

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
1	1	31.8	3231	85.9			
1	2	29.1	3171	84.0			
2	1	31.0	3068	86.2			
2	2	48.5	3101	89.0			
3	1	29.6	3029	85.9			
3	2	36.7	3249	85.5			
4	1						
4	2						
5	1	30.7	3139	85.8			
5	2	35.5	3241	85.2			
6	1	32.7	3182	86.2			
6	2	53.4	3172	89.9			
7	1	27.8	3114	85.1			
7	2	40.9	3192	86.8			
8	1	28.5	3206	85.1			
8	2	32.5	3222	84.6			
9	1	29.3	3099	85.9			
9	2	30.5	3165	84.4			
10	1	27.3	3119	85.0			
10	2	33.7	3220	84.9			
11	1	27.5	3224	84.8			
11	2	30.4	3167	84.3			
12	1	28.3	3226	85.0			
12	2	38.1	3236	85.9			
13	1	31.0	3155	85.8			
13	2	34.7	3227	85.1			
14	1	35.7	2940	87.9			
14	2	52.4	3274	89.2			
15	1	44.0	3107	89.6			
15	2	41.4	3007	87.7			
16	1	37.3	2941	88.3			
16	2	71.2	3077	94.8			
17	1	34.7	3267	86.6			
17	2	39.0	3283	85.9			
18	1	35.7	3090	87.3			
18	2	35.6	3190	85.5			
19	1	37.6	3078	87.7			
19	2	60.2	3261	91.2			
20	1	32.7	3112	86.3			
20	2	56.2	3285	90.1			

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1	37.7	3257	87.3			
21	2	52.4	3207	89.5			
22	1	36.5	3258	87.0			
22	2	46.2	3239	87.8			
23	1	40.0	3045	88.5			
23	2	71.1	3157	94.4			
24	1	37.0	3251	87.2			
24	2	43.7	3274	87.0			
25	1	39.9	3275	87.9			
25	2	43.8	3198	87.4			
26	1	39.5	3190	87.9			
26	2	41.7	3178	87.0			
27	1	27.3	3033	85.4			
27	2	30.2	3245	83.9			
28	1	34.8	3208	86.7			
28	2	41.3	3246	86.6			

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
NJG 218L3	33	5	F	9.0	L4	Y	21303	+12	D	1	3-1-83	3	71	29.83	69						
										2	3-8-83	3	70	29.82	62						

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
1	1	25.0	2300	88.9			
1	2	19.0	2300	88.7			
2	1	21.0	2300	90.0			
2	2	22.0	2300	90.4			
3	1	26.0	2550	90.2			
3	2	21.0	2300	90.0			
4	1	28.0	2300	90.4			
4	2	21.0	2300	90.0			
5	1	27.0	2550	90.5			
5	2	23.0	2300	90.8			
6	1	30.0	2550	91.4			
6	2	23.0	2300	90.8			
7	1	29.0	2300	90.8			
7	2	21.0	2300	90.0			
8	1	29.0	2550	91.1			
8	2	23.0	2300	90.8			
9	1	26.0	2300	89.4			
9	2	20.0	2300	89.4			
10	1	27.0	2550	90.5			
10	2	21.0	2300	90.0			
11	1	26.0	2300	90.0			
11	2	21.0	2300	90.0			
12	1	27.0	2300	90.5			
12	2	22.0	2300	90.4			
13	1	27.0	2300	90.5			
13	2	21.0	2300	90.0			
14	1	25.0	2300	92.0			
14	2	27.0	2300	92.3			
15	1	28.0	2300	92.9			
15	2	29.0	2300	93.0			
16	1	35.0	2300	92.9			
16	2	27.0	2300	92.7			
17	1	35.0	2300	92.9			
17	2	30.0	2300	93.7			
18	1	35.0	2300	92.9			
18	2	27.0	2300	92.7			
19	1	30.0	2300	92.7			
19	2	29.0	2300	93.3			
20	1	35.0	2300	92.9			
20	2	28.0	2300	93.0			

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1	35.0	2300	92.9			
21	2	29.0	2300	93.3			
22	1	34.0	2300	92.6			
22	2	29.0	2300	93.3			
23	1	34.0	2300	92.6			
23	2	27.0	2300	92.7			
24	1	36.0	2300	93.1			
24	2	28.0	2300	93.0			
25	1	36.0	2300	93.1			
25	2	28.0	2300	93.0			
26	1	30.0	2300	92.7			
26	2	28.0	2300	93.0			
27	1	22.0	2300	88.2			
27	2	18.0	2300	88.0			
28	1	34.0	2300	92.6			
28	2	27.0	2300	92.7			

		FULL THROTTLE			PART THROTTLE		
FUEL NO	RUN NO	SPK ADV	RPM	ROAD O.N.	SPK ADV	RPM	ROAD O.N.
21	1	28.0	2000	95.0			
21	2	27.0	2000	95.6			
22	1	26.0	2000	94.2			
22	2	22.0	2000	93.6			
23	1	27.0	2000	94.6			
23	2	26.0	2000	95.3			
24	1	32.0	2000	96.5			
24	2	27.0	2000	95.6			
25	1	34.0	2000	97.2			
25	2	34.0	2000	97.3			
26	1	31.0	2000	96.2			
26	2	29.0	2000	96.0			
27	1	14.0	2000	88.5			
27	2	12.0	2000	87.5			
28	1	23.0	2000	92.9			
28	2	21.0	2000	93.1			

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
OA2 216A3	38	4	F	8.8	L4	Y	30866	+ 8	D	1	3-29-83	3	73	29.34	23						
										2	3-30-83	3	72	29.40	28						

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
1	1	12.0	2000	87.5			
1	2	11.0	2000	87.0			
2	1	17.0	2000	90.0			
2	2	16.0	2000	90.1			
3	1	16.0	2000	89.5			
3	2	14.0	2000	88.8			
4	1	20.0	2000	91.5			
4	2	19.0	2000	92.0			
5	1	18.0	2000	90.5			
5	2	15.0	2000	89.5			
6	1	21.0	2000	92.0			
6	2	18.0	2000	91.4			
7	1	15.0	2000	89.0			
7	2	14.0	2000	88.8			
8	1	22.0	2000	92.4			
8	2	19.0	2000	92.0			
9	1	14.0	2000	88.5			
9	2	11.0	2000	88.1			
10	1	16.0	2000	89.5			
10	2	15.0	2000	89.1			
11	1	16.0	2000	89.5			
11	2	16.0	2000	90.1			
12	1	18.0	2000	90.5			
12	2	17.0	2000	90.8			
13	1	19.0	2000	91.0			
13	2	17.0	2000	90.8			
14	1	28.0	2000	95.0			
14	2	26.0	2000	95.3			
15	1	32.0	2000	96.5			
15	2	29.0	2000	96.0			
16	1	26.0	2000	94.2			
16	2	24.0	2000	94.6			
17	1	26.0	2000	94.2			
17	2	24.0	2000	94.6			
18	1	28.0	2000	95.0			
18	2	26.0	2000	95.3			
19	1	31.0	2000	96.2			
19	2	28.0	2000	95.8			
20	1	25.0	2000	93.8			
20	2	23.0	2000	94.1			

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1	17.0	3250	94.2			
21	2	18.0	3250	94.3			
22	1	18.0	3250	94.4			
22	2	18.0	3250	94.3			
23	1	19.0	3250	94.6			
23	2	18.0	3250	94.3			
24	1	19.0	3250	94.6			
24	2	18.0	3250	94.3			
25	1	20.0	3250	94.8			
25	2	20.0	3250	94.8			
26	1	17.0	3250	94.2			
26	2	17.0	3250	94.0			
27	1	9.0	3250	90.0			
27	2	8.0	3250	90.0			
28	1	14.0	3250	93.0			
28	2	16.0	3250	93.6			

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
OA2 216A3	30	47	C	8.8	L4	Y	17000	+ 8	D	1	1-10-83	3	70	30.17	50						
										2	1-11-83	3	70	30.08	50						

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	RPM	ROAD O.N.	PART THROTTLE SPK ADV	RPM	ROAD O.N.
1	1	6.0	1650	88.0			
1	2	6.0	1750	88.0			
2	1	9.0	1650	90.0			
2	2	9.0	1750	90.0			
3	1	10.0	1650	91.0			
3	2	10.0	1750	90.5			
4	1	12.0	3250	92.2			
4	2	12.0	3250	92.3			
5	1	11.0	1650	91.0			
5	2	10.0	1750	91.0			
6	1	13.0	3250	92.5			
6	2	12.5	3250	92.5			
7	1	9.0	1650	90.0			
7	2	8.0	1650	90.0			
8	1	11.0	1650	92.0			
8	2	11.0	1750	92.0			
9	1	8.0	1650	89.5			
9	2	8.0	1750	89.5			
10	1	9.0	1650	90.0			
10	2	9.0	1650	90.5			
11	1	10.0	1650	90.5			
11	2	9.0	1650	90.5			
12	1	12.0	1650	92.0			
12	2	12.0	1650	92.3			
13	1	11.5	1650	92.1			
13	2	11.0	1650	92.0			
14	1	15.0	1650	93.0			
14	2	15.0	1650	93.3			
15	1	21.0	3250	95.0			
15	2	21.0	3250	95.0			
16	1	18.0	3250	94.4			
16	2	18.0	3250	94.3			
17	1	16.0	3250	94.0			
17	2	18.0	3250	94.3			
18	1	18.0	3250	94.4			
18	2	18.0	3250	94.3			
19	1	18.0	3250	94.4			
19	2	18.0	3250	94.3			
20	1	16.0	3250	94.0			
20	2	18.0	3250	94.3			

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1	40.2	3300	91.5			
21	2	39.4	3200	91.3			
22	1	40.8	3200	91.7			
22	2	39.2	3300	91.3			
23	1	38.8	3500	91.2			
23	2	39.2	3000	91.3			
24	1	38.6	3100	91.2			
24	2	39.0	2900	91.3			
25	1	37.8	3200	91.0			
25	2	38.6	3200	91.2			
26	1	41.0	3600	91.7			
26	2	41.4	3200	91.8			
27	1	27.4	2900	88.7			
27	2	28.8	2800	89.2			
28	1	40.2	3100	91.5			
28	2	41.4	3300	91.8			

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
OA2 216A3	13	41	C	8.8	L4	Y	6866	+ 8	D	1		2	80	30.00	48						
										2		2									

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
1	1	29.0	2900	89.3			
1	2	28.2	3100	89.0			
2	1	28.8	2900	89.2			
2	2	29.6	3100	89.5			
3	1	27.6	2900	88.7			
3	2	28.4	3100	89.0			
4	1	29.2	3200	89.3			
4	2	28.0	3000	88.9			
5	1	28.6	3000	89.1			
5	2	27.4	3100	88.7			
6	1	29.8	2900	89.6			
6	2	28.8	3000	89.2			
7	1	32.2	3000	90.4			
7	2	31.4	3200	90.1			
8	1	31.2	3000	90.1			
8	2	30.4	2900	89.8			
9	1	31.4	3000	90.1			
9	2	29.4	3000	89.4			
10	1	31.8	3200	90.3			
10	2	30.2	2800	89.7			
11	1	33.4	3100	90.8			
11	2	32.8	3000	90.6			
12	1	30.4	2900	89.8			
12	2	29.4	3000	89.4			
13	1	31.8	3200	90.3			
13	2	32.4	3000	90.5			
14	1	37.4	3000	90.9			
14	2	38.4	3100	91.1			
15	1	40.2	3000	91.5			
15	2	39.8	3200	91.4			
16	1	39.3	3300	91.3			
16	2	40.8	3300	91.7			
17	1	41.0	3400	91.7			
17	2	40.5	3200	91.6			
18	1	38.8	3400	91.2			
18	2	40.0	3000	91.5			
19	1	39.8	3400	91.4			
19	2	42.6	3100	92.1			
20	1	38.0	3200	91.0			
20	2	39.0	3100	91.3			

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1	18.0	2500	90.6	23.0	1700	85.6
21	2	16.0	500	90.6	29.0	1700	85.8
22	1	15.0	2500	89.9	20.0	1700	84.7
22	2	14.0	2500	89.9	23.0	1700	84.1
23	1	16.0	2500	90.1	21.0	1700	85.0
23	2	15.0	2500	90.2	26.0	1700	84.9
24	1	15.0	2500	89.9	22.0	1700	85.3
24	2	14.0	2500	89.9	27.0	1700	85.2
25	1	17.0	2500	90.4	23.0	1700	85.6
25	2	15.0	2500	90.2	27.0	1700	85.2
26	1	16.0	2500	90.1	23.0	1700	85.6
26	2	15.0	2500	90.2	29.0	1700	85.8
27	1	4.0	2500	86.5	11.0	1700	81.7
27	2	5.0	2500	85.8	13.0	1700	81.2
28	1	16.0	2500	90.1	19.0	1700	84.4
28	2	14.0	2500	89.9	25.0	1700	84.6

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
NXR F25L3	37	4	F	8.2	L4	Y	20500	+ 8	D	1	12-8-82	3	73	29.10	39	12-15-82	3		75	29.33	44
										2	12-10-82	3	74	29.32	25	12-16-82	3		74	29.03	46

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	RPM	ROAD O.N.	PART THROTTLE SPK ADV	RPM	ROAD O.N.
1	1	5.0	2500	86.9	12.0	1700	82.0
1	2	6.0	2500	86.3	14.0	1700	81.5
2	1	9.0	2500	88.2	14.0	1700	82.7
2	2	8.0	2500	87.2	17.0	1700	82.4
3	1	8.0	2500	87.9	16.0	1700	83.4
3	2	9.0	2500	87.8	17.0	1700	82.4
4	1	12.0	2500	89.0	19.0	1700	84.4
4	2	11.0	2500	88.7	20.0	1700	83.3
5	1	8.0	2500	87.9	17.0	1700	83.7
5	2	8.0	2500	87.2	19.0	1700	83.0
6	1	9.0	2500	88.2	21.0	1700	85.0
6	2	10.0	2500	88.2	25.0	1700	84.6
7	1	7.0	2500	87.6	17.0	1700	83.7
7	2	7.0	2500	86.8	20.0	1700	83.3
8	1	8.0	2500	87.9	19.0	1700	84.4
8	2	8.0	2500	87.2	23.0	1700	84.1
9	1	5.0	2500	86.9	18.0	1700	84.1
9	2	5.0	2500	85.8	21.0	1700	83.5
10	1	5.0	2500	86.9	13.0	1700	82.4
10	2	7.0	2500	86.8	15.0	1700	81.8
11	1	8.0	2500	87.9	15.0	1700	83.1
11	2	7.0	2500	86.8	20.0	1700	82.7
12	1	10.0	2500	88.5	16.0	1700	83.4
12	2	12.0	2500	89.1	20.0	1700	82.7
13	1	12.0	2500	89.0	19.0	1700	84.4
13	2	11.0	2500	88.7	23.0	1700	84.1
14	1	15.0	2500	89.9	23.0	1700	85.6
14	2	14.0	2500	89.9	26.0	1700	84.9
15	1	19.0	2500	90.9	26.0	1700	86.5
15	2	15.0	2500	90.2	31.0	1700	86.3
16	1	16.0	2500	90.1	22.0	1700	85.3
16	2	13.0	2500	89.5	27.0	1700	85.2
17	1	15.0	2500	89.9	22.0	1700	85.3
17	2	15.0	2500	90.2	25.0	1700	84.6
18	1	16.0	2500	90.1	23.0	1700	85.6
18	2	14.0	2500	89.8	24.0	1700	84.4
19	1	18.0	2500	90.6	25.0	1700	86.2
19	2	16.0	2500	90.6	27.0	1700	85.2
20	1	16.0	2500	90.1	21.0	1700	85.0
20	2	15.0	2500	90.2	26.0	1700	84.7

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1	32.6	2800	92.5			
21	2	33.0	3300	92.7			
22	1	30.8	3000	91.9			
22	2	31.4	3000	92.1			
23	1	34.6	2600	93.2			
23	2	33.4	3100	92.8			
24	1	32.4	3200	92.5			
24	2	33.4	3300	92.8			
25	1	33.2	2900	92.7			
25	2	34.2	3500	93.0			
26	1	28.6	3100	91.1			
26	2	29.3	3100	91.4			
27	1	22.6	3150	89.9			
27	2	21.7	3300	89.5			
28	1	33.4	3000	92.8			
28	2	32.4	3100	92.5			

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
NTC 216L3	16	41	C	9.4	L4	N	7716	+ 4	D	1		2	82	30.05	45						
										2		2									

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
1	1	23.0	3300	90.1			
1	2	23.8	3000	90.4			
2	1	28.2	3000	92.0			
2	2	29.0	3300	92.3			
3	1	25.0	3000	90.9			
3	2	24.0	3200	90.5			
4	1	23.0	3100	90.1			
4	2	22.5	3300	89.8			
5	1	23.6	3200	90.3			
5	2	22.8	3350	90.0			
6	1	22.2	3100	89.7			
6	2	21.5	3300	89.4			
7	1	25.0	3200	90.9			
7	2	24.5	3450	90.7			
8	1	25.0	3100	90.9			
8	2	24.4	3100	90.6			
9	1	25.7	3100	91.1			
9	2	24.6	3300	90.7			
10	1	26.2	3100	91.3			
10	2	25.5	3200	91.1			
11	1	26.2	3400	91.3			
11	2	25.0	3300	90.9			
12	1	28.2	3100	92.0			
12	2	26.4	3400	91.4			
13	1	27.0	3350	91.6			
13	2	26.4	3000	91.4			
14	1	30.0	3300	91.6			
14	2	29.4	3100	91.4			
15	1	31.8	3200	92.3			
15	2	32.8	3300	92.6			
16	1	29.4	3400	91.4			
16	2	30.7	3000	91.9			
17	1	31.4	3300	91.8			
17	2	30.6	3100	92.1			
18	1	33.8	3200	92.9			
18	2	33.2	3200	92.7			
19	1	32.8	3300	92.6			
19	2	32.6	3200	92.5			
20	1	34.4	2900	93.1			
20	2	33.6	3100	92.9			

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1	28.7	2082	94.2	32.2	2130	88.5
21	2	32.8	2239	93.7	38.0	2086	89.9
22	1	31.3	2280	94.6	35.8	1984	89.1
22	2	28.2	2219	92.4	33.5	2075	87.8
23	1	31.4	2103	95.4	38.8	1936	90.5
23	2	31.6	2195	93.5	38.8	2086	89.4
24	1	28.6	2088	94.1	36.5	2053	89.1
24	2	27.5	2070	92.6	37.6	2116	89.4
25	1	33.1	2191	95.8	39.8	2065	90.4
25	2	36.7	2051	95.2	41.2	2133	91.3
26	1	32.0	2186	95.4	37.7	2101	89.4
26	2	33.4	2360	93.5	38.0	2086	89.9
27	1	19.5	2226	88.9	30.3	1890	86.3
27	2	20.9	2346	88.8	30.3	2075	86.4
28	1	25.6	2150	92.4	39.7	1907	90.6
28	2	24.5	2179	91.4	40.7	2127	91.1

MODEL CODE	CAR NO	LAB NO	EN CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
NJG 218M4	25	28	F	9.0	L4	Y	22900	+12	D	1	2-7-83	4	85	28.52	74	2-7-83	4		85	28.52	74
										2	2-11-83	4	85	28.86	74	2-11-83	4		85	28.86	74

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	RPM	ROAD O.N.	PART THROTTLE SPK ADV	RPM	ROAD O.N.
1	1	16.0	2198	87.2	27.1	2114	83.0
1	2	16.3	2046	87.9	28.7	2019	86.1
2	1	20.2	2061	90.0	29.8	1727	86.6
2	2	20.9	2137	90.0	32.4	2055	87.4
3	1	24.7	2354	90.8	32.2	2056	87.1
3	2	23.0	2153	90.8	33.0	2117	87.2
4	1						
4	2						
5	1	22.6	2222	90.6	28.1	2124	83.5
5	2	22.4	2195	90.5	14.7	2114	80.9
6	1	27.3	2192	92.9	36.2	2055	88.9
6	2	25.0	2198	91.3	32.0	2005	87.6
7	1	23.0	2206	90.7	33.3	2121	87.2
7	2	20.0	2099	89.8	29.1	1670	86.7
8	1	21.5	2228	89.7	32.3	1730	87.9
8	2	27.1	2339	91.5	34.1	2100	87.9
9	1	20.9	2258	89.4	30.2	2138	85.2
9	2	18.8	2126	88.9	28.4	2080	84.8
10	1	23.6	2387	90.0	31.6	1791	87.5
10	2	20.3	2242	89.4	31.9	2020	87.4
11	1	19.0	2150	89.0	31.2	2015	86.7
11	2	20.5	2070	90.0	30.9	2070	86.7
12	1	21.1	2050	90.4	34.0	2110	87.6
12	2	17.5	2118	91.3	31.5	1997	87.4
13	1	22.4	2212	90.5	36.0	2130	88.5
13	2	25.8	2240	91.4	33.2	2070	87.7
14	1	27.7	2210	93.2	35.2	2069	88.4
14	2	27.3	2120	92.5	37.3	2124	89.2
15	1	29.4	2056	94.6	30.3	2125	85.4
15	2	35.7	2152	94.7	40.9	2119	91.2
16	1	28.0	2057	93.9			
16	2	28.0	2050	92.7	35.7	2101	88.6
17	1	33.6	2086	96.5	41.7	2033	91.2
17	2	36.6	2419	94.0	41.7	2088	92.2
18	1	28.6	2154	93.8	37.4	2035	89.5
18	2	30.5	2094	93.5	36.5	2121	88.8
19	1	31.2	2144	95.2	38.8	2046	90.1
19	2	34.2	2360	93.7	39.8	2149	90.2
20	1	28.3	2211	93.5	37.5	2036	89.6
20	2	34.3	2156	94.5	35.7	2054	89.1

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1	27.0	2600	92.2	27.0	2300	92.5
21	2	30.0	2600	92.4	26.0	2300	92.0
22	1	21.0	2600	90.5	22.0	2300	90.7
22	2	24.0	2600	90.7	22.0	2300	90.5
23	1	27.0	2600	92.2	26.0	2300	92.1
23	2	29.0	2600	92.1	27.0	2300	92.3
24	1	28.0	2600	92.4	24.0	2300	91.4
24	2	31.0	2600	92.6	24.0	2300	91.2
25	1	28.0	2600	92.4	24.0	2300	91.4
25	2	31.0	2600	92.6	24.0	2300	91.2
26	1	23.0	2600	91.1	26.0	2300	92.1
26	2	26.0	2600	91.3	25.0	2300	91.6
27	1	14.0	2600	88.3	17.0	2300	88.6
27	2	17.0	2600	88.5	17.0	2300	88.5
28	1	23.0	2600	91.1	26.0	2300	92.1
28	2	25.0	2600	91.0	26.0	2300	92.0

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
NJG 218L3	36	4	F	9.0	L4	Y	35092	+12	D	1	3-8-83	3	70	28.80	52	3-10-83	3		77	28.81	37
										2	3-9-83	3	75	28.80	48	3-11-83	3		75	28.85	40

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
1	1	18.0	2600	89.6	16.0	2300	88.1
1	2	20.0	2600	89.5	14.0	2300	87.1
2	1	16.0	2600	89.0	17.0	2300	88.6
2	2	18.0	2600	88.9	17.0	2300	88.5
3	1	18.0	2600	89.6	19.0	2300	89.4
3	2	20.0	2600	89.5	18.0	2300	88.9
4	1	20.0	2600	90.2	20.0	2300	89.8
4	2	22.0	2600	90.1	20.0	2300	89.7
5	1	19.0	2600	89.9	21.0	2300	90.3
5	2	23.0	2600	90.4	20.0	2300	89.7
6	1	20.0	2600	90.2	21.0	2300	90.3
6	2	23.0	2600	90.4	21.0	2300	90.1
7	1	16.0	2600	89.0	20.0	2300	89.8
7	2	19.0	2600	89.2	19.0	2300	89.3
8	1	22.0	2600	90.8	20.0	2300	89.8
8	2	23.0	2600	90.4	19.0	2300	89.3
9	1	19.0	2600	89.9	17.0	2300	88.6
9	2	20.0	2600	89.5	16.0	2300	88.0
10	1	18.0	2600	89.6	18.0	2300	89.0
10	2	20.0	2600	89.5	17.0	2300	88.5
11	1	19.0	2600	89.9	18.0	2300	89.0
11	2	22.0	2600	90.1	18.0	2300	88.9
12	1	18.0	2600	89.6	21.0	2300	90.3
12	2	22.0	2600	90.1	20.0	2300	89.7
13	1	20.0	2600	90.2	19.0	2300	89.4
13	2	23.0	2600	90.4	18.0	2300	88.9
14	1	23.0	2600	91.1	19.0	2300	89.4
14	2	26.0	2600	91.3	18.0	2300	88.9
15	1	30.0	2600	92.9	27.0	2300	92.5
15	2	30.0	2600	92.4	25.0	2300	91.6
16	1	22.0	2600	90.8	24.0	2300	91.4
16	2	25.0	2600	91.0	23.0	2300	90.9
17	1	22.0	2600	90.8	24.0	2300	91.4
17	2	23.0	2600	90.4	23.0	2300	90.9
18	1	29.0	2600	92.7	25.0	2300	91.8
18	2	32.0	2600	92.9	25.0	2300	91.6
19	1	22.0	2600	90.8	28.0	2300	92.8
19	2	26.0	2600	91.3	27.0	2300	92.3
20	1	27.0	2600	92.2	25.0	2300	91.8
20	2	30.0	2600	92.4	25.0	2300	91.6

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
OA2 216M4	14	41	C	8.8	L4	Y	8838	+10	D	1	11-16-82	4	68	30.00	44						
										2		4									

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	RPM	ROAD O.N.	PART THROTTLE SPK ADV	RPM	ROAD O.N.
1	1	25.0	2000	88.9			
1	2	26.2	2200	89.5			
2	1	28.2	1950	90.4			
2	2	26.7	2300	89.7			
3	1	26.0	1800	89.4			
3	2	25.0	2100	88.9			
4	1	25.0	2000	88.9			
4	2	24.4	1900	88.7			
5	1	25.4	2100	89.1			
5	2	24.2	2000	88.6			
6	1	26.2	2300	89.5			
6	2	25.3	2300	89.1			
7	1	26.8	2000	89.7			
7	2	25.6	2400	89.2			
8	1	26.2	2100	89.5			
8	2	25.4	2200	89.1			
9	1	25.4	1900	89.1			
9	2	24.8	2100	88.8			
10	1	26.0	2100	89.4			
10	2	26.8	2200	89.7			
11	1	26.2	2200	89.5			
11	2	25.5	2400	89.2			
12	1	26.5	2200	89.6			
12	2	25.8	2000	89.3			
13	1	26.7	2000	69.7			
13	2	25.8	2000	89.3			
14	1	32.0	2300	92.3			
14	2	31.4	2100	92.0			
15	1	30.6	2400	91.6			
15	2	31.4	2200	92.0			
16	1	33.2	2100	92.9			
16	2	33.6	2300	93.1			
17	1	33.2	2300	92.9			
17	2	34.2	2100	93.4			
18	1	32.6	2200	92.6			
18	2	32.0	2100	92.3			
19	1	32.8	2000	92.7			
19	2	33.2	2300	92.9			
20	1	32.0	2300	92.3			
20	2	32.6	2200	92.6			

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1	32.0	2000	92.3			
21	2	31.6	2300	92.1			
22	1	32.6	2400	92.6			
22	2	31.4	2300	92.0			
23	1	33.4	2100	93.0			
23	2	32.8	2200	92.7			
24	1	33.8	2400	93.2			
24	2	34.4	2400	93.4			
25	1	32.8	2100	92.7			
25	2	33.2	2300	92.9			
26	1	34.2	2200	93.4			
26	2	35.8	2500	94.1			
27	1	28.0	2100	90.3			
27	2	27.2	1900	89.9			
28	1	32.0	2400	92.3			
28	2	32.8	2300	92.7			

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
OA2 216M4	31	47	C	8.8	L4	N	16000	+10	D	1	1-20-83	4	70	30.08	50						
										2	1-21-83	4	70	30.18	50						

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	RPM	ROAD O.N.	PART THROTTLE SPK ADV	RPM	ROAD O.N.
1	1	14.0	2000	90.6			
1	2	14.0	2000	90.6			
2	1	18.0	2000	92.6			
2	2	18.0	2000	92.6			
3	1	17.0	3000	92.0			
3	2	17.0	3000	92.0			
4	1	19.0	3000	93.0			
4	2	19.0	3000	93.0			
5	1	17.0	1850	92.0			
5	2	17.0	1850	92.0			
6	1	20.0	1850	93.5			
6	2	20.0	1850	93.5			
7	1	16.0	1850	91.5			
7	2	16.0	1850	91.5			
8	1	17.0	1850	92.0			
8	2	17.0	1850	92.0			
9	1	15.0	1850	91.0			
9	2	15.0	1850	91.0			
10	1	15.0	1850	91.0			
10	2	15.0	1850	91.0			
11	1	17.0	1850	92.0			
11	2	17.0	1850	92.0			
12	1	20.0	1850	93.5			
12	2	20.0	1850	93.5			
13	1	18.0	1850	92.6			
13	2	18.0	1850	92.6			
14	1	24.0	2500	95.0			
14	2	24.0	2500	95.0			
15	1	30.0	2700	97.0			
15	2	30.0	2750	97.0			
16	1	25.0	2750	95.3			
16	2	25.0	2750	95.3			
17	1	25.0	2750	95.3			
17	2	26.0	2750	95.6			
18	1	25.0	2750	95.3			
18	2	25.0	2750	95.3			
19	1	26.0	2750	95.6			
19	2	26.0	2750	95.6			
20	1	25.0	2750	95.3			
20	2	25.0	2750	95.3			

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1	25.0	2750	95.3			
21	2	26.0	2750	95.6			
22	1	25.0	2750	95.3			
22	2	25.0	2750	95.3			
23	1	26.0	2750	95.6			
23	2	26.0	2750	95.6			
24	1	26.0	2750	95.6			
24	2	26.0	2750	95.6			
25	1	29.0	2750	96.7			
25	2	29.0	2750	96.7			
26	1	27.0	2750	96.0			
26	2	27.0	2750	96.0			
27	1	17.0	2000	92.0			
27	2	17.0	2000	92.0			
28	1	23.0	2000	94.8			
28	2	23.0	2000	94.8			

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
OA2 216M4	34	5	F	8.8	L4	Y	14317	+14	D	1	1-12-83	4	73	30.07	56						
										2	1-19-83	4	73	30.39	66						

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	RPM	ROAD O.N.	PART THROTTLE SPK ADV	RPM	ROAD O.N.
1	1	20.0	1850	89.4			
1	2	20.0	1850	88.9			
2	1	26.0	1850	92.5			
2	2	25.0	1850	91.5			
3	1	25.0	1850	92.0			
3	2	25.0	1850	92.0			
4	1	28.0	1850	93.4			
4	2	27.0	1850	92.6			
5	1	25.0	1850	91.5			
5	2	25.0	1850	91.5			
6	1	29.0	1850	94.0			
6	2	28.0	1850	93.2			
7	1	22.0	1850	90.0			
7	2	22.0	1850	89.8			
8	1	27.0	1850	92.7			
8	2	27.0	1850	92.6			
9	1	22.0	1850	90.0			
9	2	22.0	1850	89.8			
10	1	23.0	1850	91.3			
10	2	25.0	1850	91.5			
11	1	24.0	1850	91.3			
11	2	25.0	1850	91.5			
12	1	27.0	1850	93.0			
12	2	28.0	1850	93.0			
13	1	27.0	1850	93.0			
13	2	27.0	1850	92.5			
14	1	34.0	1850	94.9			
14	2	34.0	1850	95.2			
15	1						
15	2						
16	1	38.0	1850	95.8			
16	2	37.0	1850	96.0			
17	1						
17	2						
18	1	39.0	1850	96.6			
18	2	36.0	1850	96.1			
19	1						
19	2						
20	1	37.0	1850	95.6			
20	2	36.0	1850	96.1			

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1						
21	2						
22	1	36.0	1850	95.4			
22	2	35.0	1850	95.8			
23	1	38.0	1850	95.8			
23	2	37.0	1850	96.3			
24	1	37.0	1850	96.2			
24	2	38.0	1850	96.5			
25	1						
25	2						
26	1						
26	2						
27	1	23.0	1850	90.7			
27	2	23.0	1850	90.3			
28	1	35.0	1850	95.2			
28	2	34.0	1850	95.5			

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
OBA 223M4	15	41	C	9.0	L4	N	8064	+ 4	D	1		4	70	30.24	53						
										2		4									

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
1	1	13.6	1900	89.9			
1	2	14.2	1800	90.2			
2	1	16.8	2100	91.6			
2	2	15.8	1700	91.0			
3	1	17.6	2100	92.0			
3	2	18.0	1800	92.2			
4	1	18.8	2100	92.6			
4	2	19.8	2000	93.2			
5	1	18.0	1900	92.2			
5	2	17.2	2100	91.8			
6	1	18.5	1700	92.5			
6	2	19.2	1800	92.8			
7	1	16.4	2000	91.4			
7	2	16.0	1900	91.1			
8	1	18.4	2200	92.4			
8	2	18.2	1800	92.3			
9	1	14.4	2000	90.3			
9	2	15.0	2000	90.6			
10	1	16.8	2000	91.6			
10	2	17.8	2000	92.1			
11	1	16.4	1800	91.4			
11	2	16.0	1800	91.1			
12	1	18.6	1900	92.5			
12	2	19.0	1900	92.7			
13	1	18.8	2100	92.6			
13	2	18.0	1800	92.2			
14	1	20.4	1900	94.0			
14	2	21.4	1800	94.5			
15	1	24.4	2000	95.8			
15	2	23.4	1800	95.3			
16	1	22.2	2100	94.8			
16	2	22.8	1900	95.1			
17	1	24.0	1800	95.6			
17	2	24.6	1900	95.9			
18	1	23.2	1800	95.3			
18	2	23.8	2000	95.5			
19	1	25.0	2000	96.0			
19	2	24.6	1800	95.9			
20	1	22.8	1700	95.1			
20	2	23.0	2000	95.2			

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1	22.8	2100	95.1			
21	2	22.0	1900	94.7			
22	1	22.4	1900	94.9			
22	2	22.0	1900	94.7			
23	1	23.0	2100	95.2			
23	2	23.4	1900	95.3			
24	1	22.8	1800	95.1			
24	2	23.4	1800	95.3			
25	1	24.2	2100	95.7			
25	2	23.8	2000	95.6			
26	1	25.8	1900	96.4			
26	2	25.0	2000	96.0			
27	1	15.6	1900	90.9			
27	2	16.4	2000	91.4			
28	1	20.0	2000	93.8			
28	2	20.6	1900	94.1			

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
OCA 223A3	19	26	F	9.0	L4	Y	3204	+12	D	1	10-21-82	3	70	30.16	61						
										2	10-22-82	3	70	30.17	66						

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
1	1	4.0	2400	90.7			
1	2	2.0	2500	90.0			
2	1	6.0	2450	91.4			
2	2	4.0	2450	90.7			
3	1	3.0	2400	90.3			
3	2	5.0	2500	91.0			
4	1	4.0	2500	90.7			
4	2	5.0	2550	91.0			
5	1	6.0	2450	91.4			
5	2	6.0	2500	91.4			
6	1	4.0	2400	90.7			
6	2	4.0	2450	90.7			
7	1	7.0	2450	91.7			
7	2	6.0	2500	91.4			
8	1	6.0	2400	91.4			
8	2	4.0	2450	90.7			
9	1	5.0	2500	91.0			
9	2	4.0	2450	90.7			
10	1	6.0	2400	91.4			
10	2	3.0	2450	90.3			
11	1	6.0	2400	91.4			
11	2	7.0	2450	91.7			
12	1	8.0	2400	92.1			
12	2	8.0	2500	92.1			
13	1	8.0	2400	92.1			
13	2	8.0	2400	92.1			
14	1	10.0	2400	92.7			
14	2	9.0	2500	92.4			
15	1	15.0	2450	94.5			
15	2	7.0	2400	91.7			
16	1	12.0	2450	93.4			
16	2	14.0	2500	94.1			
17	1	12.0	2450	93.4			
17	2	6.0	2400	91.4			
18	1	12.0	2450	93.4			
18	2	13.0	2500	93.8			
19	1	13.0	2400	93.8			
19	2	10.0	2450	92.7			
20	1	13.0	2550	93.8			
20	2	13.0	2400	93.8			

		FULL THROTTLE			PART THROTTLE		
FUEL NO	RUN NO	SPK ADV	RPM	ROAD O.N.	SPK ADV	RPM	ROAD O.N.
21	1	15.0	2550	94.5			
21	2	13.0	2500	93.8			
22	1	12.0	2400	93.4			
22	2	11.0	2400	93.1			
23	1	13.0	2400	93.8			
23	2	11.0	2500	93.1			
24	1	11.0	2450	93.1			
24	2	13.0	2500	93.8			
25	1	16.0	2450	94.8			
25	2	12.0	2500	93.4			
26	1	15.0	2450	94.5			
26	2	14.0	2500	94.1			
27	1	3.0	2450	90.3			
27	2	4.0	2450	90.7			
28	1	10.0	2800	92.7			
28	2	11.0	2450	93.1			

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
OCB 133A3	5	29	F	8.6	L6	1	9412	+10	D	1	12-15-82	3	70	30.05	40	12-15-82	3		70	30.05	40
										2	12-16-82	3	70	30.10	50	12-16-82	3		70	30.10	50

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	RPM	ROAD O.N.	PART THROTTLE SPK ADV	RPM	ROAD O.N.
1	1	2.0	1500	88.0	12.2	1350	85.2
1	2	2.3	1500	87.2	12.3	1350	83.8
2	1	6.2	1500	91.7	13.1	1350	85.5
2	2	6.8	1500	91.2	13.3	1350	84.4
3	1	6.5	1500	92.0	13.3	1325	85.6
3	2	7.5	1500	91.8	13.7	1350	84.7
4	1	7.4	1500	92.4	14.4	1350	86.1
4	2	7.4	1550	91.7	14.5	1350	85.1
5	1	5.9	1550	91.5	14.0	1350	85.8
5	2	6.0	1550	90.5	15.0	1350	85.4
6	1	7.9	1550	92.6	14.4	1350	86.1
6	2	8.7	1500	92.6	14.2	1350	85.0
7	1	4.4	1450	90.4	14.1	1350	86.0
7	2	5.0	1500	89.7	14.3	1350	85.0
8	1	7.5	1500	92.5	14.1	1325	85.9
8	2	9.5	1550	92.8	14.3	1350	84.9
9	1	4.3	1550	90.3	10.3	1350	84.1
9	2	5.1	1550	89.8	11.5	1350	83.4
10	1	5.3	1550	91.0	12.7	1350	85.3
10	2	5.4	1550	90.2	13.4	1350	84.4
11	1	5.8	1550	91.4	11.7	1325	84.8
11	2	5.7	1550	90.2	12.0	1350	83.6
12	1	6.8	1550	92.1	13.0	1400	85.4
12	2	9.3	1550	93.0	13.7	1350	84.6
13	1	7.1	1550	92.3	13.0	1300	85.4
13	2	7.7	1550	91.9	13.7	1350	84.6
14	1	7.1	1550	92.3	16.2	1300	86.9
14	2	8.7	1550	92.6	17.3	1350	86.6
15	1	11.8	1550	94.4	18.7	1350	88.0
15	2	12.7	1550	94.8	18.3	1350	87.2
16	1	12.5	1500	94.7	18.2	1350	87.8
16	2	12.7	1550	94.8	14.3	1350	85.0
17	1	13.0	1550	94.9	18.8	1325	88.0
17	2	13.0	1600	94.9	18.6	1350	87.4
18	1	12.8	1550	94.8	14.3	1400	86.1
18	2	13.4	1550	95.1	16.3	1350	86.2
19	1	12.6	1550	94.6	18.8	1350	88.0
19	2	12.8	1550	94.9	17.3	1350	86.7
20	1	13.1	1580	94.0	18.0	1350	87.6
20	2	10.8	1550	94.1	16.2	1350	86.2

		FULL THROTTLE			PART THROTTLE		
FUEL NO	RUN NO	SPK ADV	RPM	ROAD O.N.	SPK ADV	RPM	ROAD O.N.
21	1	12.7	1550	94.8	19.2	1350	88.2
21	2	12.5	1550	94.7	19.0	1350	87.6
22	1	12.1	1575	94.4	18.7	1350	88.0
22	2	12.3	1600	94.7	18.0	1350	87.2
23	1	11.9	1550	94.4	14.3	1350	86.1
23	2	11.5	1550	94.2	15.3	1350	85.6
24	1	12.0	1550	94.6	18.0	1350	87.7
24	2	13.0	1550	94.9	18.3	1350	87.3
25	1	12.9	1550	94.9	19.1	1375	88.1
25	2	13.7	1550	95.2	19.4	1350	87.8
26	1	13.4	1550	95.1	18.1	1300	85.5
26	2	12.0	1550	94.4	15.8	1350	85.9
27	1	4.0	1500	90.0	12.2	1350	84.1
27	2	4.8	1550	89.5	11.3	1350	83.2
28	1	10.1	1550	93.7	18.7	1350	88.0
28	2	10.3	1550	93.7	17.7	1350	86.9

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
OD3 238A3	6	29	F	8.65	V8	Y	14014	+10	D	1	11-7-82	3	70	29.76	50	11-7-82	3		70	29.76	50
										2	11-8-82	3	70	29.80	66	11-8-82	3		70	29.80	66

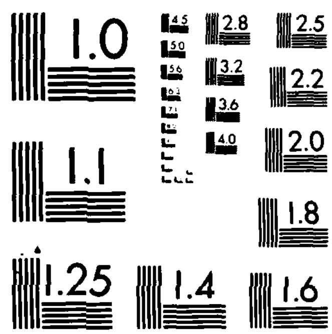
FUEL NO	RUN NO	FULL THROTTLE SPK ADV	RPM	ROAD O.N.	PART THROTTLE SPK ADV	RPM	ROAD O.N.
1	1	2.3	1500	87.7	6.3	1400	85.8
1	2	1.5	1700	87.0	6.8	1650	84.8
2	1	6.5	1600	90.7	8.0	1450	86.6
2	2	6.0	1700	91.7	9.3	1450	86.1
3	1	6.0	1500	90.4	8.0	1400	86.6
3	2	5.9	1500	91.6	8.5	1500	85.7
4	1	9.2	1500	91.9	7.8	1450	86.5
4	2	7.6	1750	92.4	9.6	1700	86.3
5	1	6.7	1500	90.8	8.7	1450	86.9
5	2	5.5	1650	91.4	9.5	1550	86.2
6	1	12.5	1500	93.2	9.5	1450	87.2
6	2	8.3	1700	92.8	10.7	1450	86.6
7	1	7.9	1500	90.4	7.7	1400	86.4
7	2	4.7	1750	91.0	9.7	1700	86.3
8	1	8.2	1800	91.5	7.7	1450	86.4
8	2	6.8	1750	92.0	9.3	1500	86.1
9	1	3.7	1500	88.8	5.5	1400	85.3
9	2	4.6	1500	90.9	9.3	1500	86.2
10	1	6.3	1600	90.5	7.7	1400	86.4
10	2	5.3	1600	91.3	9.4	1200	86.2
11	1	5.0	1800	89.8	8.7	1400	86.9
11	2	6.1	1650	91.7	9.3	1750	86.1
12	1	8.0	1500	91.4	11.0	1400	87.7
12	2	7.0	1700	92.2	10.0	1500	86.4
13	1	9.2	1500	91.9	6.3	1400	85.8
13	2	7.0	1750	92.2	11.2	1550	85.8
14	1	11.4	1750	92.9	13.0	1450	88.3
14	2	10.3	1800	93.7	13.2	1550	87.4
15	1	16.5	1550	94.5	13.7	1450	88.4
15	2	13.3	1650	95.0	15.3	1450	87.9
16	1	14.0	1500	93.7	12.3	1450	88.1
16	2	11.3	1600	94.2	12.5	1400	87.2
17	1	11.3	1550	92.8	12.0	1450	88.0
17	2	9.4	1600	93.2	12.6	1400	87.2
18	1	10.8	1500	92.6	11.7	1400	87.9
18	2	6.3	1800	91.8	12.0	1400	87.1
19	1	14.3	1550	93.8	13.3	1450	88.4
19	2	12.0	1600	94.5	13.0	1500	87.4
20	1	11.7	1550	92.9	10.5	1450	87.6
20	2	11.0	1700	94.0	12.7	1450	87.3

		FULL THROTTLE			PART THROTTLE		
FUEL NO	RUN NO	SPK ADV	RPM	ROAD O.N.	SPK ADV	RPM	ROAD O.N.
21	1	11.0	1500	92.7	11.3	1400	87.8
21	2	8.8	1750	93.1	11.7	1650	87.0
22	1	11.5	1500	92.8	13.0	1500	88.3
22	2	10.3	1650	93.7	12.5	1400	87.2
23	1	14.0	1600	93.7	13.0	1450	88.3
23	2	10.0	1800	93.6	13.8	1500	87.6
24	1	11.3	1550	93.8	13.7	1450	88.4
24	2	11.1	1700	94.1	15.0	1450	87.9
25	1	15.0	1550	94.3	12.8	1450	88.2
25	2	12.6	1700	94.6	12.9	1450	87.3
26	1	11.7	1550	92.9	11.0	1400	87.7
26	2	10.5	1600	93.8	11.6	1700	87.0
27	1	5.3	1400	90.0	5.5	1400	85.3
27	2	4.5	1500	90.8	7.5	1500	85.3
28	1	13.1	1800	93.4	11.7	1450	87.9
28	2	10.9	1650	94.0	13.1	1450	87.4

AD-A159 127 1982 CRC FUEL RATING PROGRAM: ROAD OCTANE PERFORMANCE OF OXYGENATES IN 1982 MODEL CARS(U) COORDINATING RESEARCH COUNCIL INC ATLANTA GA JUL 85 CRC-541 3/3

UNCLASSIFIED F/G 21/4 NL

END
FILMED
DTIC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963 A

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
PKB 222A3	11	7	F	8.5	L4	Y	14312	+10	D	1	11-22-82	3	71	30.25	56	11-24-82	3	5.0	71	29.85	52
										2	11-23-82	3	73	30.10	60	11-29-82	3	5.0	72	29.83	58

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
1	1	23.0	2500	88.5	29.0	2100	89.2
1	2	20.0	2500	86.2	23.0	2000	88.2
2	1	21.0	2500	87.7	33.0	2100	90.1
2	2	21.0	2500	86.6	28.0	2000	90.0
3	1	22.0	2500	88.1	29.0	2100	89.2
3	2	22.0	2500	86.9	30.0	2100	90.6
4	1	26.0	2500	89.6	32.0	2100	89.9
4	2	24.0	2500	87.5	33.0	2000	91.4
5	1	25.0	2500	89.3	29.0	2100	89.2
5	2	25.0	2500	87.8	29.0	2000	90.4
6	1	22.0	2500	88.1	33.0	2100	90.1
6	2	24.0	2500	87.5	32.0	2000	91.2
7	1	21.0	2500	87.7	28.0	2100	88.9
7	2	22.0	2500	86.9	32.0	2000	91.2
8	1	28.0	2500	90.2	32.0	2100	89.9
8	2	26.0	2500	88.2	33.0	2000	91.4
9	1	22.0	2500	88.1	29.0	2100	89.2
9	2	21.0	2500	86.6	29.0	2000	90.4
10	1	22.0	2500	88.1	30.0	2100	89.4
10	2	22.0	2500	86.8	30.0	2000	90.6
11	1	19.0	2500	86.5	31.0	2100	89.7
11	2	19.0	2500	86.0	28.0	2000	90.0
12	1	26.0	2500	89.6	30.0	2100	89.4
12	2	26.0	2500	88.1	30.0	2000	90.6
13	1	25.0	2500	89.3	26.0	2100	88.4
13	2	24.0	2700	87.5	30.0	2000	90.6
14	1	31.0	2500	90.9	36.0	2100	90.8
14	2	27.0	2700	88.4	34.0	2000	91.6
15	1	41.0	2700	91.5	36.0	2100	91.4
15	2	27.0	2700	90.2	36.0	2000	90.8
16	1	33.0	2700	89.9	33.0	2100	90.7
16	2	23.0	2700	89.3	35.0	2000	90.6
17	1	37.0	2700	90.8	37.0	2100	91.1
17	2	26.0	2700	90.0	33.0	2000	90.2
18	1	36.0	2700	90.5	33.0	2100	90.7
18	2	25.0	2700	89.8	30.0	2000	89.5
19	1	34.0	2700	90.1	37.0	2100	91.6
19	2	26.0	2700	90.0	34.0	2000	90.4
20	1	34.0	2700	90.1	34.0	2100	91.0
20	2	26.0	2700	90.0	30.0	2000	89.5

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1	34.0	2700	90.1	38.0	2100	91.8
21	2	24.0	2700	89.5	39.0	2000	91.4
22	1	34.0	2700	90.1	33.0	2100	90.7
22	2	25.0	2700	89.8	34.0	2000	90.4
23	1	35.0	2700	90.3	35.0	2100	91.2
23	2	26.0	2700	90.0	32.0	2000	90.0
24	1	37.0	2700	90.8	30.0	2100	90.0
24	2	25.0	2700	89.8	33.0	2000	90.2
25	1	38.0	2700	91.0	35.0	2100	91.2
25	2	28.0	2700	90.5	37.0	2000	91.0
26	1	35.0	2700	90.3	39.0	2100	92.0
26	2	26.0	2700	90.0	37.0	2000	91.0
27	1	24.0	2700	86.9	23.0	2100	88.3
27	2	17.0	2700	87.4	20.0	2000	86.8
28	1	34.0	2700	90.1	40.0	2100	92.2
28	2	23.0	2700	89.3	38.0	2000	91.2

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
PKB 222A3	21	26	F	8.5	L4	Y	10775	+12	D	1	10-29-82	3	70	29.92	63						
										2	11-1-82	3	71	29.89	56						

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	RPM	ROAD O.N.	PART THROTTLE SPK ADV	RPM	ROAD O.N.
1	1	-1.0	1700	85.8			
1	2	-1.0	1650	85.5			
2	1	1.0	1700	86.6			
2	2	1.0	1750	86.5			
3	1	3.0	1750	87.4			
3	2	3.0	1600	87.5			
4	1	9.0	1850	90.0			
4	2	4.0	1750	88.0			
5	1	5.0	1650	88.2			
5	2	2.0	1650	87.0			
6	1	7.0	1750	89.0			
6	2	4.0	1900	88.0			
7	1	5.0	1850	88.2			
7	2	4.0	1750	88.0			
8	1	4.0	1700	87.8			
8	2	3.0	1750	87.5			
9	1	4.0	1650	87.8			
9	2	0.0	1650	86.0			
10	1	1.0	1700	86.6			
10	2	1.0	1750	86.5			
11	1	5.0	1750	88.2			
11	2	4.0	1800	88.0			
12	1	10.0	1650	90.5			
12	2	7.0	1750	89.7			
13	1	6.0	1650	88.6			
13	2	1.0	1650	86.5			
14	1	11.0	1600	91.0			
14	2	8.0	1600	90.3			
15	1	13.0	1650	91.7			
15	2	9.0	1650	91.0			
16	1	13.0	1650	91.7			
16	2	6.0	1850	89.0			
17	1	14.0	1600	92.0			
17	2	12.0	1800	92.2			
18	1	12.0	1700	91.3			
18	2	7.0	1650	89.7			
19	1	12.0	1700	91.3			
19	2	8.0	1700	90.3			
20	1	12.0	1700	91.3			
20	2	8.0	1650	90.3			

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1	16.0	1700	92.7			
21	2	5.0	1800	88.5			
22	1	6.0	1650	88.6			
22	2	9.0	1850	91.0			
23	1	12.0	1750	91.3			
23	2	7.0	1650	89.7			
24	1	12.0	1600	91.3			
24	2	4.0	1650	88.0			
25	1	15.0	1750	92.3			
25	2	13.0	1700	92.8			
26	1	14.0	1650	92.0			
26	2	10.0	1650	91.4			
27	1	3.0	1650	87.4			
27	2	1.0	1700	86.5			
28	1	11.0	1600	91.0			
28	2	7.0	1700	89.7			

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
PME 137A3	12	7	F	8.4	L6	Y	28222	+16	D	1	11-2-82	3	74	30.11	60	11-4-82	3	5.0	71	29.92	60
										2	11-3-82	3	72	30.06	58	11-5-82	3	5.0	72	30.05	54

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	RPM	ROAD O.N.	PART THROTTLE SPK ADV	RPM	ROAD O.N.
1	1	15.0	2400	85.6	35.0	2400	90.7
1	2	18.0	2400	86.3	29.0	2400	90.0
2	1	20.0	2400	88.1	32.0	2400	90.2
2	2	24.0	2400	88.9	31.0	2400	91.5
3	1	19.0	2400	87.7	32.0	2400	90.2
3	2	22.0	2400	88.2	27.0	2400	90.4
4	1	22.0	2400	88.9	30.0	2400	89.8
4	2	24.0	2400	88.9	27.0	2400	90.4
5	1	19.0	2400	87.7	29.0	2400	89.6
5	2	22.0	2400	88.2	28.0	2400	90.7
6	1	22.0	2400	88.9	31.0	2400	90.0
6	2	25.0	2400	90.2	29.0	2400	91.0
7	1	19.0	2400	87.7	30.0	2400	89.8
7	2	22.0	2400	88.2	28.0	2400	90.7
8	1	19.0	2400	87.7	33.0	2400	90.4
8	2	24.0	2400	88.9	30.0	2400	91.2
9	1	16.0	2400	86.5	30.0	2400	89.8
9	2	21.0	2400	87.8	29.0	2400	90.0
10	1	19.0	2400	87.7	32.0	2400	90.2
10	2	22.0	2400	88.2	29.0	2400	90.0
11	1	20.0	2400	88.1	35.0	2400	90.7
11	2	22.0	2400	88.2	27.0	2400	90.4
12	1	21.0	2400	88.5	31.0	2400	90.0
12	2	26.0	2400	89.5	30.0	2400	91.2
13	1	19.0	2400	87.7	29.0	2400	89.6
13	2	24.0	2400	88.9	27.0	2400	90.4
14	1	21.0	2400	88.5	33.0	2400	90.4
14	2	30.0	2400	90.5	32.0	2400	91.8
15	1	26.0	2400	89.7	40.0	2400	91.7
15	2	29.0	2400	90.3	40.0	2400	93.6
16	1	27.0	2400	90.1	31.0	2400	90.2
16	2	28.0	2400	90.0	38.0	2400	93.0
17	1	27.0	2400	90.1	32.0	2400	89.5
17	2	27.0	2400	89.8	33.0	2400	91.5
18	1	27.0	2400	90.1	34.0	2400	91.1
18	2	27.0	2400	89.8	38.0	2400	93.0
19	1	29.0	2400	90.8	33.0	2400	90.8
19	2	31.0	2400	90.8	38.0	2400	93.0
20	1	26.0	2400	89.7	37.0	2400	91.9
20	2	27.0	2400	89.8	35.0	2400	92.1

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1	27.0	2400	90.1	37.0	2400	91.9
21	2	29.0	2400	90.3	38.0	2400	93.0
22	1	27.0	2400	90.1	41.0	2400	93.0
22	2	27.0	2400	89.5	40.0	2400	93.6
23	1	26.0	2400	89.7	36.0	2400	91.7
23	2	30.0	2400	90.5	37.0	2400	92.7
24	1	27.0	2400	90.1	38.0	2400	92.2
24	2	29.0	2400	90.3	39.0	2400	93.3
25	1	28.0	2400	90.4	36.0	2400	91.7
25	2	28.0	2400	90.0	39.0	2400	93.3
26	1	27.0	2400	90.1	36.0	2400	91.7
26	2	26.0	2400	89.5	37.0	2400	92.7
27	1	17.0	2400	86.2	26.0	2400	87.7
27	2	17.0	2400	86.2	27.0	2400	89.6
28	1	28.0	2400	90.4	38.0	2400	92.2
28	2	28.0	2400	90.0	43.0	2400	94.4

MODEL CODE	CAR NO	LAB NO	EN CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
E 215A3	22	26	F	8.9	L4	Y	7800	+ 5	D	1	2-8-83	3	62	30.05	59						
										2	2-9-83	3	72	29.77	90						

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	RPM	ROAD O.N.	PART THROTTLE SPK ADV	RPM	ROAD O.N.
1	1	2.0	3100	88.3			
1	2	1.0	3100	87.6			
2	1	2.0	3200	88.3			
2	2	2.0	3200	88.0			
3	1	4.0	3000	89.3			
3	2	4.0	3200	88.8			
4	1	5.0	3100	89.8			
4	2	5.0	3200	89.2			
5	1	3.0	3100	88.8			
5	2	3.0	3100	88.4			
6	1	6.0	2900	90.2			
6	2	6.0	3100	89.6			
7	1	4.0	3100	89.3			
7	2	3.0	3100	88.4			
8	1	6.0	2500	90.2			
8	2	6.0	3000	89.6			
9	1	2.0	3100	88.3			
9	2	3.0	3200	88.4			
10	1	1.0	3150	87.8			
10	2	1.0	3200	87.6			
11	1	3.0	3100	88.8			
11	2	1.0	3200	87.6			
12	1	6.0	3100	90.2			
12	2	7.0	3100	90.0			
13	1	6.0	3000	90.2			
13	2	5.0	3200	89.2			
14	1	7.0	2600	90.5			
14	2	7.0	2000	90.0			
15	1	10.0	3200	91.6			
15	2	10.0	3300	91.0			
16	1	10.0	2000	91.6			
16	2	9.0	2000	90.7			
17	1	9.0	3300	91.3			
17	2	9.0	3200	90.7			
18	1	9.0	2000	91.3			
18	2	10.0	3100	91.0			
19	1	9.0	3200	91.3			
19	2	10.0	1900	91.0			
20	1	9.0	3100	91.3			
20	2	8.0	3100	90.3			

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1	9.0	3100	91.3			
21	2	10.0	3200	91.0			
22	1	8.0	3100	90.9			
22	2	9.0	1900	90.7			
23	1	8.0	3300	90.9			
23	2	8.0	1900	90.3			
24	1	10.0	3200	91.6			
24	2	10.0	3200	91.0			
25	1	10.0	3250	91.6			
25	2	11.0	3200	91.3			
26	1	11.0	2500	92.0			
26	2	11.0	2000	91.3			
27	1	1.0	3200	87.8			
27	2	3.0	3200	88.4			
28	1	9.0	2500	91.3			
28	2	10.0	3100	91.0			

MODEL CODE	CAR NO	LAB NO	EM CT	C.R.	CYL	AIR CND	ODOM MILES	STD SPK	TST LOC	RUN NO	FULL THROTTLE DATE	G	AMB TMP	BAROM	HUM	PART THROTTLE DATE	G	MAN VAC	AMB TMP	BAROM	HUM
J 315M5	17	41	C	9.3	L4	N	20440	+18	D	1		4	65	29.94	37						
										2		4									

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	RPM	ROAD O.N.	PART THROTTLE SPK ADV	RPM	ROAD O.N.
1	1	37.0	2500	90.8			
1	2	38.8	2400	91.4			
2	1	38.8	2600	91.4			
2	2	38.0	2500	91.0			
3	1	39.4	2700	91.6			
3	2	38.4	2400	91.2			
4	1	39.9	2400	91.9			
4	2	39.0	2500	91.5			
5	1	37.0	2500	90.6			
5	2	38.4	2300	91.2			
6	1	39.6	2400	91.7			
6	2	38.8	2400	91.4			
7	1	38.6	2300	91.3			
7	2	40.0	2300	91.9			
8	1	40.8	2200	92.2			
8	2	41.7	2200	92.6			
9	1	38.5	2200	91.2			
9	2	40.4	2600	92.1			
10	1	36.8	2600	90.5			
10	2	37.4	2500	90.7			
11	1	38.2	2100	91.1			
11	2	39.5	2000	91.7			
12	1	40.8	2400	92.2			
12	2	40.0	2500	91.9			
13	1	37.6	2300	90.8			
13	2	39.8	2500	91.8			
14	1	41.4	2500	92.0			
14	2	40.6	2300	91.6			
15	1	40.6	2600	91.6			
15	2	41.2	2300	91.9			
16	1	42.8	2300	92.5			
16	2	43.8	2500	92.9			
17	1	44.6	2600	93.3			
17	2	43.2	2400	92.7			
18	1	42.5	2300	92.4			
18	2	43.4	2300	92.8			
19	1	40.0	2600	91.3			
19	2	41.4	2500	92.0			
20	1	42.0	2500	92.2			
20	2	41.4	2600	92.0			

FUEL NO	RUN NO	FULL THROTTLE SPK ADV	FULL THROTTLE RPM	FULL THROTTLE ROAD O.N.	PART THROTTLE SPK ADV	PART THROTTLE RPM	PART THROTTLE ROAD O.N.
21	1	41.8	2400	92.1			
21	2	41.8	2500	92.1			
22	1	43.2	2400	92.7			
22	2	44.2	2300	93.1			
23	1	40.4	2200	91.5			
23	2	41.2	2500	91.9			
24	1	42.2	2500	92.3			
24	2	43.0	2500	92.6			
25	1	44.6	2300	93.2			
25	2	45.0	2300	93.4			
26	1	42.6	2400	92.5			
26	2	41.0	2500	91.8			
27	1	38.4	2600	91.2			
27	2	39.6	2300	91.7			
28	1	41.2	2500	91.9			
28	2	42.6	2300	92.5			

END

FILMED

10-85

DTIC